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CERTAIN ASPECTS OF MINERAL REQUIREMENTS[1]

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THE prescription of drugs and the formulation of diets appear to belong, superficially, to different professions. The line of separation, however, has never been precise. Infusions, broths and teas prescribed in ancient and medieval times contained foodstuffs with caloric value as well as substances with medicinal properties. Recent progress in nutrition and therapeutics has broadened the field of each without clarifying the above mentioned issue. The number of essential food factors which increases yearly may be given as an example; each in turn may be claimed by doctor and dietitian. At present, the controversial point as to whether vitamins should come from the apothecary shop or the grocery store is undecided. Minerals occupy a similar borderline position.

It is assumed that under most conditions of normal living the mineral requirements will be satisfied by a well-balanced diet. In several pathological states and in a few conditions associated with physiological changes, the proper mineral intake may not be achieved. Either arbitrary selection of improper foodstuffs or failure of the body to indicate the proper minerals that it needs may be at fault. It is probably trite to affirm that the human body is sufficiently ingenious as to possess a danger signal for inadequate ingestion of calories and for inadequate intake of fluid. It is less readily appreciated that we have no recognized signal to indicate a lack of minerals, either as salts *per se* or as constituents of food. If an individual is not ingesting sufficient food, the pangs of hunger tell him so. If the body lacks water, the sensation of thirst prompts him to drink. But if one is deficient in sodium chloride or calcium salts the deficiency persists until it is recognized by clinical signs or by chemical analyses of body fluids.

It is unnecessary to enumerate in this paper the clinical signs of salt deficiency or to present a detailed discussion of the chemical constituents of biological media. It seems expedient, however, to review the subject of the mineral constituents of certain compartments of the

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body in order that the dietary treatment of the sick may be better understood. Bone, tissue cells and spaces around tissue cells are the three gross compartments of the body. Each is believed to possess its own acid-base characteristics. We know that the bony structures are composed largely of calcium and phosphorus. The cells which make up the soft tissues of the body have a different chemical pattern and contain in addition to water and complex organic compounds, potassium as the principal base. Between and surrounding the tissue cells are the interstitial spaces which claim sodium as the principal base.

If information is desired about the concentration of bases in the various compartments of the body, it is neither convenient nor necessary to analyze directly a sample of bone, tissue cells or interstitial fluid. The concentration of the constituents of the blood serves as a useful substitute. If a sample of blood is taken from a vessel in the arm, transferred to a centrifuge tube and prevented from coagulating by the addition of heparin, whole blood similar in many respects to that which circulates in the body is obtained. The concentration of the mineral constituents of the blood cells may be assumed for our purpose to be comparable to tissue cells. Similarly, the concentration of the constituents of the serum, except for protein, is not unlike that in the fluid outside of the cells.

The chemical constituents and their concentrations in a sample of serum from a normal person (1) are given in the table. The concentrations are expressed in milliequivalents per liter of serum because this system of nomenclature is preferable to the antiquated expression of milligrams per 100 cc. It is of small concern to remember concentration values, but it is desirable to recognize the base constituents: sodium, potassium, calcium, and magnesium. The acids are not segregated in body inclosures as precisely as are the bases. Chloride, bicarbonate and phosphate are all distributed rather abundantly in the intracellular and extracellular spaces.

Although the three large compartments in the body have been defined, this discussion will be concerned with only one. Calcium and phosphorus have their own cubicle in the human body as well as in "the hall of nutrition" and will be considered only briefly. Our knowledge of the metabolism of minerals in the tissue cells is not advanced sufficiently to justify an extensive presentation. Tables of the constituents of bone or cells, therefore, will not be given.

We offer a moderate presentation of our material for we do not hesitate to

TABLE 1

Normal concentration of constituents of serum

CONSTITUENT	AVERAGE RANGE FOR NORMAL BLOODS	
	Concentration per 100 cc.	Milli-equivalents (m.eq.) per liter
Total fixed base		150–155
Sodium	320–324 mg.	139–141
Potassium	15.6–19.5 mg.	4–5
Calcium	9.4–10.8 mg.	4.7–5.4
Magnesium	1.8–2.4 mg.	1.5–2.0
Total carbon dioxide	56–61 vol.	25–27
Chloride	362–376 mg.	102–106
Protein	6.4–7.5 gm.	15.5–18.0
Phosphate	3.1–4.5 mg.	2.0–2.5
Non-protein nitrogen	20–35 mg.	
Uric acid	3–5 mg.	

admit that there are wide gaps of knowledge in the subject of mineral metabolism and much of it will be modified and complemented by future investigations. The order for discussion of the pathological states was chosen arbitrarily. Addison's disease will be considered first. The other dyscrasias will follow in a non-logical order.

Loeb (2) made the pertinent observation in 1932 that a patient with Addison's disease, during a crisis from adrenal insufficiency, had a decreased amount of sodium chloride in the body. He demonstrated, subsequently, that a high sodium chloride diet was beneficial in the treatment of this condition. While many of the details of the pathogenesis of the changes are not understood, it is recognized that in the precritical period there is a renal dissipation of sodium chloride associated with an inadequate amount of circulating adrenal cortex hormone. Conversely, an adequate amount of adrenal cortex hormone, identified as desoxycorticosterone acetate, exercises a sodium-retaining effect and prevents the disruption of the acid-base equilibrium of the body. A secondary effect of the chemical metamorphosis in an adrenal crisis is an increase in the concentration of potassium in the serum.

The original observations of Loeb have been amply confirmed and it is accepted by most observers that a high sodium chloride diet has increased the life expectancy for persons with this fatal malady. A minimum of 10 gm. of table salt, in addition to that contained in the diet, is given to all of our patients with Addison's disease. The diet should also be high in carbohydrates. This régime should be maintained indefinitely. Because of the high concentration of potassium in the serum, Wilder (3) has recommended a low potassium intake as an adjunct to the increased sodium intake. It is his belief that no more than 1.5 gm. of potassium should be ingested daily. Our patients have been unable to adhere to a diet with such a low content of potassium and prefer a higher potassium intake because it makes the diet more palatable. We have been content, therefore, to follow a middle course. Substances high in potassium such as meat, fish, fowl, vegetables, dried fruits and nuts are allowed only in moderate amounts.

Patients with Simmond's cachexia or hypopituitarism may have an associated atrophy of the adrenal cortex. Many of the symptoms as well as the changes in the blood are similar to those seen in patients with Addison's disease. In several patients with hypopituitarism that we have studied, a high sodium chloride intake has been very beneficial.

Pneumonia, influenza, the common cold, grippe and fevers of short duration may be accompanied by a demonstrable depletion of water and sodium chloride. The depletion is a combination of the effects of at least three phenomena. Sweating is increased in fever and with increased loss of fluid in the sweat, there is an increased loss of salt. Since most of the sweat comes from the interstitial fluid spaces, sodium is the principal base lost. Secondly, a fever may be accompanied by a transient diuresis which entails a further drain on the body stores of water and salt. Lastly, anorexia or loss of appetite prevents normal replacement. It seems expedient, therefore, in any acute fever to select foods with a high sodium chloride content whenever a choice is available. Soups, broths

and other salty fluids may be complemented with 6 to 8 gm. of table salt. The advice to "feed a cold and starve a fever" and to "force fluids" in patients with fever should be modified to provide for a combined liberal fluid and salt intake. Patients with fevers of long duration such as typhoid fever, subacute bacterial endocarditis and certain types of lymphomas become adjusted to the chronic loss of salt in the sweat and the need for replacement is not critical.

Surgical operations and convalescence are accompanied also by sweating with an increased loss of water and salt from the interstitial fluid spaces. Patients undergoing operations of short duration who have been in good physical condition immediately prior to the operation, may withstand the loss without undesirable effects. Other individuals, less furtunate, may suffer from the depletion, *per se*. At the time of operation the concentration of the electrolytes of the serum should be as close to normal as possible. During the first days of the postoperative period, parenteral salt solution should be given to most patients. During convalescence, a high salt diet should suffice.

During the past decade, one of our particular interests in the laboratory at the Massachusetts General Hospital and in conjunction with the Harvard Fatigue Laboratory has been the dietary requirements imposed by high environmental temperatures. This interest has prompted us to make investigations in parts of this continent where high temperatures are prevalent. Panama Canal Zone, Boulder Dam and the southwestern desert in the United States, the steel mills in Youngstown, Ohio, as well as our own laboratory in Boston have afforded us opportunity to pursue this problem.

The belief that the limitation of protein is desirable for persons exposed to high temperatures is widespread. There is little evidence to support this. The desirability of an adequate protein intake for persons engaged in hard physical labor in the heat should not be questioned. A large proportion of carbohydrate foods may supply the remaining calories. Of equal importance is an adequate mineral and fluid intake. Persons doing hard physical work should receive at least 15 gm. of sodium chloride in addition to that contained in the diet. It is most important that the high salt intake be provided during the first hot days of a heat wave. The loss of salt in the sweat is greatest during this time for as the heat wave is prolonged, adjustment of the sweat glands occurs. Acclimatization under such conditions is effective because of a decreasing concentration of salt in the sweat. The amount of fluid lost in the sweat is unchanged, however, for fluid must continue to be excreted at the same rate to allow for dissipation of heat. No attempt should be made to restrict the intake of this substance. The kidneys need fluid to carry off waste products as at other times. The temperature of water for summer consumption should be governed by the desires of the individual. There is little evidence that cool water in optimum quantities is harmful.

Failure to observe precautionary measures such as these produces physiological changes, which if uncorrected, may assume pathological significance. During the first hours or days after the onset of hot weather a loss of weight takes place. This is caused by a loss of water and

salt in the sweat greater than the intake. A feeling of malaise and thirst accompanies this change. The sensation of thirst is for fluid only, as the body is not able to specify fluid which contains salt. The desire for salt is probably physiological in animals but man has passed this stage in the evolutionary scale. If the sensation of thirst in man is satiated by replacement of the fluid without salt, loss of salt in the sweat continues and results in a serious depletion of body stores. Subsequently, a breakdown of physiological processes occurs and the subject becomes a patient suffering from heat cramps. Etiologically, the production of heat exhaustion and heat stroke is different, but many of the prodromata mentioned above are common to all forms of the ill effects of heat.

Diabetes insipidus is the only condition recognized at present which, in the absence of edema, reacts unfavorably to a high sodium chloride intake. Patients with diabetes insipidus have an extreme thirst and drink from 5 to 20 liters of water daily. This large turnover of fluid is accompanied by a very precise adjustment of sodium metabolism. If one upsets this balance by adding 10 gm. of salt to the diet or restricts the fluid intake, intense thirst develops. Conversely, a diet which contains less than 5 gm. of salt allays thirst and promotes a feeling of well-being.

It has been assumed that all of the dyscrasias which have been discussed have not been accompanied by a disturbance of renal function and have shown no inability to excrete water and salt. The next disease to be discussed, nephritis, is accompanied by organic and functional changes which are evident from the failure to excrete waste products and, frequently, water and minerals as well. The disturbances may reach such proportion as to demand modification of the ingesta with regard to both mineral and fluid content. The dietary changes which should be instituted vary with the patient according to the type of renal lesion and the functional degree of impairment.

Since the nomenclature for the types of nephritis varies among the several clinics of this country, no attempt will be made to advocate any particular classification. Broad terms only will be used such as acute nephritis, nephrosis, and chronic nephritis with and without edema.

It has been the custom in the past for physicians and dietitians to speak of a "nephritic diet" for patients with renal lesions. This term generally has signified a low protein, low salt, and low fluid consumption. There are very few patients, however, who benefit by a combined restricted intake. It is proposed, therefore, that the term "nephritic diet" be deleted from contemporary thinking and relegated to the past.

Many patients with nephritis lose albumin constantly through the kidneys and should have extra protein added to their diet rather than have it withheld. Only when a patient fails to eliminate most of the nitrogenous waste products should the amount of protein be limited. Even then it is doubtful if the amount of protein should be less than one gram per kilogram of body weight.

With the proposal of one modification in the dietary treatment of nephritis, we should like to have you now consider another. This is concerned with the

amount of sodium chloride ingested. The popular prejudice that excess salt leads to thickening of the blood and to arteriosclerosis has been discredited by scientific investigation. In most hospitals the greater portion of the food is cooked without added salt. When food is served, a salt-shaker is placed on all trays except those intended for patients with nephritis or cardiac failure. Even with the utmost supervision such diets rarely contain less than 3 gm. of salt per day and most certainly do not appeal to the fickle appetites of the sick. The addition of salt during the preparation of food in the kitchen undoubtedly makes it more palatable. It would be fair to estimate that 3 gm. of added salt per person per day would suffice to season food. Thus 6 gm. would be the minimum total content of sodium chloride. This amount is well tolerated by patients with nephritis and heart disease without edema and it may accomplish a great deal toward the nourishment of the other patients who are in the majority. In particular cases with marked edema a diet low in salt should be served.

In addition to restriction of protein and salt, restriction of fluid has been advocated for patients with nephritis. The harm that this dictum has done cannot be overestimated. We believe that all patients with nephritis should have an increased fluid intake. This is applicable to patients with or without edema. The only exception is edema from cardiac decompensation which may be observed late in the course of chronic renal failure.

If patients with nephritis do not show edema, there should be no objection to a fluid intake sufficient to carry off the necessary solids. With a diminished concentrating ability, from 4 to 6 liters per day may be required to perform this task. Loss of significant quantity of edema fluid may be noted if one follows the daily weight of a patient on a high fluid régime. This may be carried one step further. Patients with anuria or oliguria may likewise benefit from a high fluid intake. A clinical example will illustrate this:

> This patient, 32 years old, was suffering from an acute toxic nephritis and during the 6 days before admission had voided no urine (4). The non-protein nitrogen was 260 mg. per cent and a very poor prognosis seemed justified. Large amounts of salt solution were given by vein and liberal amounts of fluid were allowed by mouth. The kidneys began to function within 18 hours after the beginning of this treatment. During the next few days the urine output rapidly increased to more than 3 liters per day and the non-protein nitrogen decreased. The patient subsequently experienced a satisfactory convalescence. It is believed that if we had been reluctant to give large amounts of fluid and salt we might have prevented recovery.

Extraordinary steps may be necessary to remove the excess fluid in patients with nephritis and edema. It will be recalled that sodium is the principal base in interstitial fluid and with an increase of fluid such as occurs in edema, there is an increased amount of sodium in the body. Restriction of sodium intake obviously is desirable. We should not be content only with the restriction of sodium chloride, but should attempt to remove excess water and salt. This may be accomplished by the ingestion

of ammonium chloride. Ammonium chloride forms acid in the body by conversion of the ammonium radicle to urea, leaving the chloride available to combine with sodium. If a sufficient amount of sodium chloride is formed in this manner, it will be excreted with fluid from the interstitial spaces. From 5 to 15 gm. of ammonium chloride may be given daily for a three-day period to accomplish this. A diet which contains less than 2 gm. of sodium chloride should be consumed simultaneously. The palatability of such a diet may be improved by the addition of 2 or 3 gm. of potassium chloride. The latter salt improves the taste, but does not supply base for retention of edema fluid.

There are two conditions which respond to a high potassium intake and presumably are associated with a disturbance of potassium metabolism. Herrington reported in 1937 (5) the favorable response to the daily ingestion of potassium citrate in two patients with familial periodic paralysis. This observation has been confirmed by several investigators. From 4 to 8 gm. daily of either potassium citrate or potassium chloride may be used. Equally important in the treatment of this disturbance of unknown etiology is the avoidance of "carbohydrate sprees". A high carbohydrate meal may be the forerunner of an acute attack of paralysis. During the past 18 months we have followed one boy with this disease who has adhered to our recommendations on all except three occasions. Each time that he attended a birthday party or a dinner at his church the abundance of ice cream and cake overtaxed his usual restraint. An attack of paralysis followed within 12 hours.

Ménière's syndrome with tinnitus and vertigo is the other dyscrasia which is benefited by a high potassium intake (6). Mygind and Dederding (7) demonstrated that a diet low in sodium chloride and moisture prevented frequent attacks of tinnitus and vertigo. A similar effect may be produced with a normal diet and high potassium intake. This pleases patient and dietitian alike, because the low sodium diets previously recommended were difficult to prepare and unpalatable to eat. During the past two years we have treated more than 30 patients on a normal diet plus 6 to 8 gm. of potassium chloride. The clinical results are reassuring. The hazards that we have encountered from the daily ingestion of large amounts of potassium are not significant. The body is able to tolerate an excess of this mineral and no untoward effects have appeared.

The use of a sodium citrate-citric acid mixture is a recent advance in the treatment of various disorders of calcium metabolism. It is endowed with a twofold function. The native mixture of molar citric acid and molar sodium citrate is acid in the intestines and promotes absorption of calcium. During the assimilation, the citrate radicles are converted to carbon dioxide and water, leaving an alkaline medium which is favorable for the deposition of calcium in bone. Shohl and Butler (8) have demonstrated the effectiveness of this mixture in the treatment of two patients with infantile rickets. We have used it successfully in one patient with renal rickets and nephrocalcinosis.

The dietary treatment of gout will conclude this discussion. Again, the prejudice is generally held that a high

protein diet is detrimental to patients with this disease. This bias was based upon the premise that gout was confined to those who ate and drank well, hence enjoyed a high protein intake. It was appreciated, further, that a caloric debauch might be followed by an acute attack of joint distress. It has been demonstrated in our laboratory (9) that gout is as frequent among the middle and lower classes of society as it is among the upper strata. It is not a disease of the wealthy, nor is it confined to those who overeat. Traumata to the body seem most important in inciting an acute attack of gout. Thus, exposure to cold, chills, injury to a joint directly or a surgical operation on the soft tissues of the body may be sufficient. We believe that a heavy meal or an alcoholic debauch belongs in the same category. We have shown that the incidence of attacks of acute gout on a low protein and a scrupulously low purine diet may be as great as on a diet which contains a liberal portion of meat daily. The only foodstuffs to be avoided are those excessively high in purines, such as liver (and liver concentrates), kidneys and sweetbreads. A liberal fluid intake is important as well as a reducing diet for those who are overweight.

CONCLUSIONS

This has been a miscellaneous collection of dietary exhortations. A few prejudices have been exposed which should be relegated to the past rather than fostered for the future. It is interesting to note that in the treatment of many conditions we complement rather than supplement the diet. The contrast between the food faddist and the physician is obvious. The faddist uses one or several foods to an extreme without regard to a well-rounded, varied and balanced diet for the nourishment of the body; the physician uses the average normal diet to answer the need entailed by superimposed requirements.

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PLANNING THE DAY'S DIET FOR VITAMIN CONTENT[1]

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LIKE all other nutritive essentials, the vitamins must be supplied in the diet in adequate amounts if growth and health are to result. Planning of diets to this end depends upon a knowledge of the quantities of each of these nutrients needed by the body and of their quantitive occurrence in foods. This discussion is an attempt to summarize briefly and in a practical way the information now available. The subject as a whole is relatively new and opinions expressed at this time must be considered more or less tentative in nature. It is urgently requested that this approach be kept distinctly in mind in accepting the values given, so that future revisions made necessary by new data obtained in studies now under way or undertaken later will seem logical and in order.

Both in the case of vitamin requirements and vitamin content, the values derived in different studies usually cover a wide range and the reviewer must either select the single value that seems to him the most reliable or derive a composite value that in his judgment is most representative of the data at hand. The judgment of the reviewer as well as the variation in the values being summarized is, therefore, an important factor to be considered in appraising summaries that are given.

The vitamins to which attention is to be given should, perhaps, be described briefly as to functions and properties.

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Vitamin A and its Precursors: Vitamin A is essential for growth and is required for reproduction and lactation. This vitamin is especially concerned with maintaining the integrity of the epithelial structure, particularly that of the respiratory passages, glands, ducts of glands and the digestive tract. Vitamin A is also essential for normal vision. A prolonged low intake results in nutritional night blindness or inability to see clearly in dim light. This vitamin has been isolated and chemically identified, and methods for producing it on a commercial scale are now being studied.

Vitamin A as such does not occur in plants but is present there in the form of the precursor, carotene, which is converted into vitamin A in the animal body, presumably in the liver. Since this conversion is not necessarily complete, foods of animal origin such as milk and eggs contain both carotene and vitamin A. Liver oils such as fish liver oils, on the other hand, contain only vitamin A.

Vitamin-B Complex or the Water-Soluble Vitamins: The only ones of this group that will be dealt with here are vitamin B_1 or thiamin, riboflavin or vitamin G, nicotinic acid, and vitamin B_6.

Vitamin B_1 (thiamin) is required specifically for the prevention of polyneuritis or beriberi, and also for growth. It is especially important during pregnancy and lactation. This vitamin is concerned with the metabolism of carbohydrates. It functions in the body in the form of the phosphorylated com-

pound, cocarboxylase, which comprises the prosthetic group of the enzyme responsible for the release of energy through the oxidation of pyruvic acid.

Plant tissues contain vitamin B_1 as such; in the animal body it exists mostly in the phosphorylated form. Phosphorylation probably takes place in the liver.

Riboflavin (vitamin G) is required for normal growth. Rats deprived of riboflavin show loss of hair and present a stunted appearance. There is also a peculiar vascularization of the cornea and one investigator has consistently reported cataract as common among such animals. In man, deprivation of riboflavin results in characteristic lesions at the corners of the mouth. These lesions are not identical with those seen in pellagra and are not cured by nicotinic acid.

Riboflavin, in combination with phosphoric acid, forms the prosthetic or active group of a series of enzymes of which the yellow respiratory enzyme catalyzes the oxidation of hexosemonophosphate in the tissues.

Nicotinic acid or its amide is required for the prevention and cure of pellagra. Whether it may be referred to as the pellagra-preventing factor on the assumption that pellagra is a clinical entity in which nicotinic acid alone is involved, remains to be determined. Nicotinic acid is a component of the prosthetic group of a series of enzymes concerned in the oxidation-reduction processes of cells.

Vitamin B_6 has now been identified chemically, and methods for producing it on a commercial scale are under investigation. Although the evidence bearing on the significance of this vitamin in human nutrition is not very definite, preliminary findings indicate that it is very probably essential. Its function in animal nutrition has been studied chiefly in relation to the well-being of the rat. When deprived of vitamin B_6 these animals develop a well defined dermatosis characterized by symmetrical lesions on the feet and the lower part of the face. In the advanced stages the paws become swollen and raw, and the facial lesions may extend to the eyes and also the outer periphery of the ears. This condition is sometimes referred to as rat-pellagra but is distinct from human pellagra since it is not cured or alleviated by the administration of nicotinic acid.

Vitamin C (Ascorbic Acid): Vitamin C is essential for the cure and prevention of scurvy. A dietary supply of vitamin C is known to be required only by man, monkeys and apes, and the guinea-pig. Rats are able to synthesize the vitamin from other dietary components and this is presumably true of other species also.

The primary function of vitamin C apparently is to maintain the intercellular or cementing substance of the connective tissue. It is necessary for the maintenance of normal tooth structure at all times, as well as firmness of the gums. Continued deprivation of vitamin C lowers capillary resistance with the result that there may be hemorrhages in muscles and other tissues. The mechanism of the function of vitamin C has not been elucidated.

Vitamin D: This vitamin assists in the deposition of calcium and phosphorus in teeth and bones. The vitamin does not take the place of, or lessen the need for these elements, but simply makes conditions satisfactory for their deposi-

tion. Just what the mechanism of the reaction is, has not been determined.

Several forms of vitamin D have been identified but only two are important from the standpoint of human nutrition. These are natural vitamin D or D_3 occurring in largest amounts in fish liver oils and artificial vitamin D or D_2 (calciferol) obtained by the irradiation of ergosterol.

VITAMIN REQUIREMENTS

Expression of vitamin requirements cannot yet be given with any degree of exactitude, and considering the many factors that influence the need for these substances it is doubtful if they can ever be summarized precisely without considerable accompanying exposition. For most of these factors the requirement is dependent on one or more of a number of conditions such as sex, age, body weight, activity, physiological state, type and composition of the diet and possibly also the prevailing climatic conditions.

Progress in determining vitamin requirements has been hampered by the lack of reliable methods and also by the necessity for considering criteria to be used as the basis of measurement. In consequence, vitamin requirements have been described for different levels of nutritional status. Values derived from the determination of the amount required to prevent a specific pathological condition are usually taken as representing minimum protective quantities, while those obtained in connection with dietary studies or in balance experiments are taken as indicating more nearly adequate amounts. Optimal quantities, that is, quantities in excess of which additional amounts do not produce a measurable improvement in any aspect of nutritional well-being, are also frequently described.

As a result of this situation, values covering a wide range have been offered for each of the vitamins as expressive of the requirement. This in itself is evidence of the lack of exact knowledge of this subject unless one wishes to construe it as indicating a choice of values depending upon the level at which nutritional status is to be maintained.

A word of caution is perhaps advisable here in connection with expressions of requirement derived through the use of predetermined values for the vitamin content of foods. Even though the International standards and the corresponding International units have been in use for some time, values for the vitamin content of foods given in biological units still comprise a large proportion of those available. In order to use these in conjunction with values given in International units, attempts have been made to derive factors for converting biological units to equivalents in International units. Biological units vary greatly in value from laboratory to laboratory and from time to time even in the same laboratory. A series for vitamin A recently examined by the author indicated that one Sherman (Munsell) unit might be equivalent to anything from 0.4 to 1.25 I. U. and that designation of a fixed ratio for unqualified use as a conversion factor was not advisable. Values derived by the use of such conversion factors should, therefore, be considered in the nature of approximations.

Vitamin A: Determination of vitamin A requirement is complicated by the fact that foods containing substances

other than vitamin A may serve as a source of this vitamin in the body. These so-called precursors of vitamin A include *alpha*, *beta* and *gamma* carotene and cryptoxanthin. *Beta* carotene usually predominates, and for the sake of brevity they are generally referred to collectively as carotene. At low levels of intake carotene is almost as well utilized as vitamin A but at higher levels the conversion of carotene is less complete. The quantity actually converted seems to depend upon the state of saturation of the liver with respect to vitamin A.

A series of tests with several species of animals has indicated that vitamin A requirement is most probably related to body weight.

The preponderance of evidence on the requirement of this vitamin has been obtained by determining the amount required to maintain normal dark adaptation. Vitamin A is a constituent of the retinal pigment, visual purple, essential to vision in dim light. A deficiency of vitamin A in the diet results in a lowered rate of formation of this substance, a condition best recognized by inability of the subject to distinguish objects clearly in dim light and commonly known as night blindness. Determination of the amount of vitamin A required to prevent this condition and maintain normal dark adaptation has been taken as a basis for estimating vitamin A requirement. The quantity so determined represents the physiological minimum and does not allow for optimum storage in the body.

On the basis of body weight, vitamin A requirement for man has been estimated at from 41 to 50 I. U. per kilogram per day. The results from dietary studies indicate a somewhat higher value as desirable. From the standpoint of adequacy a range of 3000 to 5000 I. U. daily is suggested. An intake of anything less than 2000 I. U. per day should be considered below the indispensable minimum and an intake of 6000 to 8000 units may probably be taken as optimum or as sufficient to assure good storage in the tissues under normal conditions. The supply during pregnancy and lactation and for children and adolescents should be well within the optimum range.

Vitamin B_1 (*Thiamin*): The well-known studies of Cowgill and associates on several species of animals have pointed to a definite relation between vitamin B_1 requirement and energy metabolism. The specific rôle of vitamin B_1 in carbohydrate metabolism was recently corroborated by studies showing that the requirement is best expressed on the basis of the non-fat constituents of the diet.

Vitamin B_1 is excreted in the urine. By suitable tests designed to measure the exact amount needed to keep the body in equilibrium, considerable information has been obtained on the requirement for this factor.

The indispensable minimum for vitamin B_1 seems to be in the region of 200 I. U. per day. For the average adult of moderate activity, 300 to 400 I. U. daily may be taken as adequate and 500 to 600 units daily should assure optimum nutrition. The allowance during pregnancy and lactation should be several times that for the non-pregnant woman. Children also need considerably more in proportion to their weight than do adults.

Vitamin C: Several methods for determining vitamin C requirement have

been used. These include the capillary resistance test, the urinary excretion or saturation test and the blood saturation test. Of the three, the first seems to give the least reliable results. The second depends upon the assumption that tissue saturation represents the desirable physiological state which may or may not be the case. The blood test apparently cannot be used as an absolute measure although values above or below the presumably normal range seem to signify high or low degrees of saturation.

The concomitant results of such tests indicate that 20 to 25 mg. (400 to 500 I. U.) of ascorbic acid per day represents the minimum necessary to prevent scurvy, while 40 to 60 mg. (800 to 1200 units) per day is probably adequate and 80 mg. (1600 units) sufficient to meet all needs. During pregnancy and lactation the allowances should be fully twice the values given above. The requirement for children is only slightly, if any, less than that for adults, and infants may need much more in proportion to their weight than adults.

Vitamin D: Since vitamin D is so intimately connected with the cure and prevention of rickets it was only natural that cure or prevention of this disease should be used as the basis for determining the requirement of this vitamin. The method is applicable, however, only in the case of young children, and values so determined cannot be considered as meeting more than minimum requirements which places a distinct limitation on the use of this criterion.

Measurement of calcium and phosphorus retention has been used to some extent and probably offers the most reliable means of determining the actual need for vitamin D. Calcium and inorganic phosphorus content of the blood have been shown to be unsatisfactory as criteria. Vitamin D is undoubtedly a factor in growth and improvement in growth serves as a measure of amounts needed for optimum nutrition.

In discussing vitamin D requirement it is necessary to give attention to the effectiveness of the two most common forms, natural vitamin D or D_3 occurring in largest amounts in fish liver oils and artificial vitamin D (D_2 or calciferol) sold as an irradiated solution of ergosterol in oil under the trade name "Viosterol". Some species, notably the chicken, show a marked difference in their ability to utilize these two forms of vitamin D, requiring much more vitamin D_2 (judged on a rat unit basis) than vitamin D_3 for the same effect. There is some evidence of a similar difference with the human species. Concentration or dispersion of vitamin D in the medium in which it is administered also seems to influence its effectiveness, solutions of high concentration being somewhat less efficacious than more dilute solutions.

The majority of studies on vitamin D requirement have been made at levels of intake comparable to the quantities found in vitamin D milk or in the usual dosage of cod-liver oil. The requirement cannot be stated any more closely, therefore, than these figures will permit. In consideration of the results from such studies it seems logical to say that when the calcium and phosphorus content of the diet is adequate and the proportion of these elements not unusual, an intake of 135 I. U. of vitamin D per day will prevent rickets in the majority of cases but will not necessarily cure the disease

once it has developed. A supply of 300 to 400 I. U. daily seems fully adequate for the prevention and cure of rickets and 675 units sufficient for normal growth.

No data are at hand for judging the vitamin D needs beyond childhood, but care should probably be taken to have an assured source during adolescence in view of the rapid growth at that time.

The question of the vitamin D requirement of the adult is still to be answered. As far as clinical evidence goes, there is little indication that this is not met under ordinary circumstances. During pregnancy and lactation there should undoubtedly be an increase in the intake of vitamin D as well as of calcium and phosphorus.

Riboflavin (Vitamin G): Very little is known of the riboflavin requirement. No serious study has been made of criteria for judging the need for this factor and too few data are available on its occurrence in foods to allow of making estimates from dietary studies. The value most commonly accepted is 600 Bourquin-Sherman units (approximately 200 micrograms) per day.

Nicotinic Acid: The quantity of this substance required in normal nutrition is not known. The curative dose for pellagra varies greatly in amount from individual to individual as well as according to the severity of the disease. Curative doses have been reported ranging from 50 to 1000 mg. Thirty grams of dried yeast daily is generally considered adequate for the prevention of pellagra. If we accept the statement that 1.0 mg. of nicotinic acid is contained in 4 to 10 gm. of yeast, then the requirement for nicotinic acid might be given as 3.0 to 7.5 mg. daily.

SUMMARY

For convenience, the values suggested in the foregoing discussion are summarized in table 1. Attention is again called to the fact that the exact requirement is not yet known for any of the vitamins and further, that it may never be possible to express these needs exactly in a practical way since they vary from individual to individual and for different physiological states in the same individual. The values given were selected as representing quantities that will assuredly satisfy minimum requirements of the average individual under average conditions and offer a range that will support a condition coming well within the usually accepted meaning of the term "normal nutrition". The optimal values are stated with somewhat less assurance since the conditions for determining these are less well defined and there is greater difference of opinion in regard to them.

The suggestion may be made that these values for requirements are somewhat lower than those given by others. In anticipation of this it seems advisable to state certain points that should leave no doubt as to their significance and basis of selection. The values given, with the exception of those for vitamin D, represent quantities of the vitamins readily supplied in the diet by natural foods. They refer to quantities presumably present in the food when it is eaten. In selecting these values for requirements no allowance was made for variation in the availability of the vitamin value in different types of foods. Furthermore, these values represent the *daily* requirement of normal subjects. They do not represent amounts sufficient

for the speedy correction of conditions arising from the long continued and persistent use of diets that were low in any of these factors.

SELECTING FOODS TO MEET VITAMIN REQUIREMENTS

After values for vitamin requirements have been accepted the next problem is to choose foods for the daily diet that will meet these needs. If this is to be done exactly, tables of vitamin values must be prepared. In this case the problem of selection is more complex perhaps than it is for values expressive of vitamin requirement. Not only do different foods vary widely in the kinds and amounts of vitamins they contain but different samples of a given food may show wide variation in their content of a single vitamin. Tables giving ranges to cover such variations are difficult to use when a single value is needed and single values accompanied by an exact description of the sample of food on which they were obtained may be misleading when applied categorically to other samples of this food. Attempts have been made, therefore, to set up tables of a more general nature in which single values for the various vitamins are given for foods listed, with little or no description of each food from the standpoint of factors that may have had

TABLE 1

Values suggested as expressive of the daily requirement for vitamins A, B_1, C, D and riboflavin

VITAMIN	FOR THE AVERAGE ADULT UNDER AVERAGE CONDITIONS			DURING PREGNANCY AND LACTATION	FOR GROWING CHILDREN AND ADOLESCENTS
	Absolute minimum	Adequate	Optimum		
A	2000 I.U.	3000 to 5000 I.U.	6000 to 8000 I.U.	more	8000 to 10,000 I.U.
B_1 (thiamin)	200 I.U.	300 to 400 I.U.	500 to 600 I.U.	several times the allowance for adults	considerably more in proportion to their weight than adults
C (ascorbic acid)	20 to 25 mg. *or* 400 to 500 I.U.	40 to 50 mg. *or* 800 to 1200 I.U.	80 mg. *or* 1600 I.U.	twice that for non-pregnant women	only slightly less than that for adults
D	not known			800 I.U. suggested as adequate	300 to 400 I.U. suggested as adequate for protection against rickets—675 I.U. suggested as desirable to assure optimum growth
Riboflavin (vitamin G)	approximately 600 Bourquin-Sherman units				at least 400 Bourquin-Sherman units

an influence on its initial vitamin content. Generally there are wide discrepancies in the values presented in the numerous tables of this kind that have been prepared, except in a few instances where only one value for a food has appeared in the literature, and there is little basis for judging which of these tables may be the most reliable. A further complication brought about by

TABLE 2

Foods grouped for vitamin value according to food type

FOOD GROUP	INTERNATIONAL UNITS PER 100 GRAMS FRESH, EDIBLE PORTION			
	Vitamin A	Vitamin B_1 (thiamin)	Vitamin C (ascorbic acid)	Riboflavin (vitamin G)
Vegetables (except as noted below)	bleached 0 others, trace to 1000 according to green or yellow color	50	200	40
thin green leaves	15,000		800	150
other green leaves	1000 to 5000		800	90
yellow types	according to depth of color			
cabbage family (cabbage, Brussels sprouts, cauliflower, collards, broccoli)			1200	
roots (kohlrabi, turnips, rutabagas)			800	
Fruits (except as noted below)	low unless green or yellow	30	200	25
apricots, guavas, mangoes, prunes	1000			
citrus (grapefruit, oranges, lemons, limes, tangerines)			850	
tomatoes			450	
Seeds, mature, dry				
grains	0	100	0	25
legumes (peas, beans, soybeans)	variable according to greenness	150 to 200	0	100
nuts	less than 100	150 to 200	0	100
Meat			cooked 0	
muscle (except as noted below)	less than 100	50		125
pork		250 or more		
liver	6000 or more	100		600
other organs		75		300
Eggs	1000	30	0	140
Milk and milk products				
whole	100	25	fresh 3	60
skimmed	10	25		60
butter	2400	0		
cheese	according to fat content			250

the use of data expressed in biological units has already been referred to under the discussion of requirements.

The values for vitamin requirements summarized in the foregoing discussion refer to the quantities of the vitamins actually to be consumed each day. This brings up an important point that must be kept in mind if these estimates are used as standards when planning diets. Most food before it is eaten is subjected to conditions or treatments that reduce its original vitamin content in one respect or another. Possible decrease in the vitamin content of a food should be taken into account when its contribution to the diet is reckoned, rather than simply entering it on the basis of an assay value obtained when it was in a relatively fresh state. Cooked food cannot be taken as having the full vitamin value of the fresh raw product, for foods cooked by some methods retain very little if any of their original vitamin potency.

With this rather difficult situation in regard to selecting food for vitamin value the question is, "what is to be done about it?" In the first place it points clearly to the necessity for assuring a liberal supply of vitamin-rich foods in the diet and for taking every precaution to retain as much as possible of the initial vitamin value during preparation of the food for serving; and secondly, it shows the futility of worrying over whether the diet contains an exact number of units of this or that vitamin as calculated from the figures given in current tables. In consideration of these facts and for the purposes of this discussion, an attempt has been made to generalize as to the vitamin content of foods with a view to presenting data that may be useful in the rapid selection of a diet adequate in its supply of vitamins.

Most foods may be classified for vitamin value according to type. Thin green leaves are all excellent sources of vitamin A with values ranging in the neighborhood of 15,000 I. U. per 100 gm. of fresh edible portion. Other green and yellow vegetables are somewhat less rich, assaying from something less than 1000 to 5000 units per 100 gm. Most vegetables in the fresh state, that is, raw, are good sources of vitamin B_1, averaging approximately 50 units per 100 gm. The citrus fruits are all excellent sources of vitamin C. The complete classification according to this scheme is given in table 2. In using this material it must be kept in mind that it is offered for use in general diet planning only and must be applied with a full appreciation of its limitations.

SEVEN CENTURIES OF SCIENTIFIC NUTRITION[1]

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THE study of the history of science by younger students is often discouraged on the ground that no one has time to read even the new literature because it is so voluminous. There are four excellent reasons for studying the history of any science. The first is that it affords a pleasant recreation and an insight into the human activity that accompanies discovery. Hobbies and recreational pursuits need not be defended on the basis of utility.

The second reason for studying the history of a science is that it provides a means of attaining a genuine understanding of the present theories and practices. Frequently one finds that he cannot understand some modern phase of science. The reason for this often lies in an attempt to master the complex, final picture before one sees the beginning. If one starts with the first simple observations that were made by the original discoverers and fixes these clearly in mind, he can often trace the development of a field into modern times and really grasp the final, more complex structure. Any student who finds himself thwarted in grasping a given field of science should take time to turn to its history.

The third reason for acquiring a genuine background is that it increases the ability to grasp modern discoveries in a short time. The person who states that he lacks time to study the history of science will usually prove to be more deficient in current knowledge than one who is well grounded in the earlier literature. He is also usually more easily swayed in his research by current fads and therefore shapes his investigations by his impressions of these.

The fourth reason for studying history is that great discoveries have often been obscured for hundreds of years. This is especially true in nutrition for there have been long periods during which men were afflicted with disease due to bad diets. Yet means of correcting these diets were available. Methods of alleviation have often been discovered but left unheeded in the literature. There is no reason to believe even now that we know all the literature can teach us today. There are probably many observations still buried in the old works that could be used with immense profit to our modern civilization.

The history of nutrition is one of the most fascinating for exploration. From the beginning men have eaten. Throughout the ages men have written about their foods. Whatever paths one prefers to follow he is constantly learning about the food habits of men. If tastes run to religious literature, there are food habits to record; if inclinations lead toward works of travel and adventure, the food supply proves to be a vital item. While we often imagine that our modern food habits are based upon recent experimental science, much of our evidence indicates that these dietary practices are hundreds of years old.

In view of the great abundance of material for approaching the study of nutrition from an historical angle, one

[1] Read before the Massachusetts Dietetic Association, Northampton, May 6, 1939.

is constantly disappointed in the conventional, hackneyed introduction that is found in the usual textbook. Most of such introductions are threadbare, having been copied from text to text. They are hopelessly dull because the author has neglected his source material. Thus the voyages of Captain Cook are fascinating as described in some of the early reports but represent a certain guarantee of permanent nausea even to a young mind after they have been reviewed in a dozen conventional articles.

In a brief review such as the present one, consideration can only be given to a few discoveries. These represent a random selection rather than an attempt to select the outstanding events of the past seven centuries.

A MONK OF THE MIDDLE AGES DESCRIBES OUR RESEARCH FOR 1950

Roger Bacon was one of the great scientists of the 13th century. He is supposed to have died about 1292 and to have been entombed at Oxford where he had completed much of his research. Roger Bacon discusses many fields of science in his great work known as *Opus Majus*. His object in writing this work was to convince the Pope of that time that the civilized world should engage very actively in research as a means of checking the Mohammedan advances. For the popes of the 13th century trembled before the power of the Moslem world.

Bacon was especially interested in the use of the experimental method to learn how to check the advances of age upon the human body. He saw clearly that man had it within his power to study the aging process, but he could not cite many examples of how this had been achieved in the past. Bacon quotes an earlier author in stating, "Diet without Physik sometimes did good but Physik without due order of Diet never made man one jot the better." Bacon claimed that the three causes of old age were infection, negligence, and ignorance. In regard to aging Bacon says, "No one wishes to take thought in regard to them (methods of prevention), not even physicians since we see that scarcely one physician in a thousand will give this matter even slight attention. Very rarely does it happen that any one pays sufficient heed to the rules of health. No one does so in his youth, but sometimes one in three thousand thinks of these matters when he is old and approaching death for at that time he fears for himself and thinks of his health. But he cannot then apply a remedy because of his weakened powers and senses and his lack of experience." As a method of attack Bacon suggests "that the wonderful and ineffable utility and splendor of experimental science may appear and the pathway may be opened to the greatest secret of secrets."

In proceeding with this discussion Bacon says: "Not only are remedies possible against the conditions of old age coming at the time of one's prime and before the time of old age but also if the regimen of old age should be completed, the conditions of old age and senility can still be retarded, so that they do not arrive at their ordinary time, and when they do come they can be mitigated and moderated, so that both by retarding and mitigating them life may be prolonged, beyond the limit which according to the full regimen of health depends on the six articles mentioned. And there is another farther limit, which

has been set by God and nature, in accordance with the property of the remedies retarding the accidents of old age and senility and mitigating their evil. The first limit can be passed but the second cannot be."

Bacon wished to prepare the elements of food for ingestion so that there would be a maintenance of the status quo within the body. He states "if the elements should be prepared and purified in some mixture so that there would be no action of one element on another but so that they would be reduced to pure simplicity." He then involves his religious thinking into this idea by observing that "this condition will exist in our bodies after the resurrection. For an equality of elements in those bodies excludes corruption forever."

Finally Bacon sounds very modern when he faces the problems of aging and states, "But owing to the great difficulty of this very great experiment and because few take an interest in experiments, since the labor involved is complicated and the expense very great and because men pay no heed to the secrets of nature and the possibilities of art, it happens that very few have labored on this very great secret of science and still fewer have reached a laudable end."

Today we are beginning to appreciate the foresight of Roger Bacon. The changes in the composition of our population indicate that we have a future to face where the concern must be much greater for those in the later stages of life. The nutrition student of the past has neglected the whole field of adult nutrition. He has shown no recognition of the ideas of Roger Bacon that the processes of aging can be modified by diet. In the course of a week one can read all the papers that have ever been written about the effect of diet upon aging and the life span of experimental animals. However, there are indications that after seven centuries the seeds sown by Roger Bacon are germinating. Even another decade may witness his project well under way.

The attack upon the problem of aging by the biochemist and nutritionist is not unduly difficult. It does require cooperation between the nutrition worker and the pathologist, however. Perhaps the nutrition specialist of the future must be trained in pathology if he is to follow the trail of Roger Bacon.

The future will probably witness more and more nutrition workers comparing the effects of different diets upon animals during their entire span of life instead of a fraction of this span. Such research is especially suitable for departments concerned primarily with human nutrition. We may even anticipate that the ultimate solution of the difficult problems concerned with diseases of the heart, of the lungs and even those of tumors, may lie in the hands of nutrition workers who have the patience to observe the effects of diets during the whole span of life. The new work edited by Cowdry and entitled *Problems of Ageing* may stimulate us to follow the directions of Bacon after seven centuries of neglect.

CORNARO ATE LITTLE AND LIVED LONG: STARK ATE SIMPLY AND DIED OF SCURVY

Many have devoted much of their lives to a study of their own diet. Some have reported their findings but the mass must be represented by an "unknown soldier". Two who wrote about their dietary practices were Luigi Cornaro

(1464–1566) and Wm. Stark (1741–1770).

Cornaro was born in Venice but lived much of his life in Padua. Like many others he lived carelessly until about the age of forty. He reached this age about a dozen years after Columbus discovered America. At the ages of 83, 86, 91, and 95 he wrote the four sections of his famous *Discorsi della Vita Sobria*. This small work appeared in its first edition in 1558 and has since passed through many translations with an American edition entitled the *Art of Long Living* published in 1917.

All his life he preached what Milton was later to express so beautifully:

> "... if thou well observe
> The rule of—Not too much: by Temp'rance taught,
> in what thou eat'st and drink'st; seeking from thence
> Due nourishment, not gluttonous delight,
> Till many years over thy head return:
> So may'st thou live till, like ripe fruit, thou drop
> Into thy mother's lap, or be with ease
> Gather'd, not harshly pluck'd; for death mature.

It is hard to tell why Cornaro did not die of vitamin deficiencies except that he was enthusiastic about eggs and his bread was probably made from coarse flour. For the poor he advocated bread, soup, and an egg. For the well-to-do he included some meat. He found he could not tolerate fruit but he advocated it for those who could. He ate about 14 ounces of food per day and drank an equal weight of wine. Being an Italian he was not very favorably inclined toward water. Such was the life and diet of Luigi Cornaro. He will long be remembered as a great teacher of temperate living.

In contrast to Cornaro was Stark who devoted his short life to the science of nutrition. His sole experimental animal was himself. Stark was a medical student in Glasgow and Edinburgh at about the time Cook was sailing around the earth. His training was finished at Leyden in 1767. He became a friend of Benjamin Franklin who told him of his early experience when he prospered upon bread and water. Franklin had long since dropped this method of becoming fat and adopted more pleasant ones.

Stark was the forefather of our studies with simplified diets. He gave himself scurvy by living upon a diet of bread and sugar. He ate mustard and caraway seeds to learn how long it took food to pass through the body. He observed that more fat was excreted when he ate tallow in contrast to olive oil. Thus he concluded that a hard fat was more poorly utilized than a soft one. This was before the age of hard, hydrogenated fats. He gave himself scurvy upon a diet of honey and flour but not upon one rich in meat. More than half a century before biochemists appreciated that fats and proteins had different energy values, Stark queried "Is it possible that a small quantity of fat may afford the same nourishment as a larger quantity of lean meat?"

Some of Stark's critics objected to his experiments on the ground that only one person was involved. Stark's reply was the following, "All inductions from experience are at best only greater or less degrees of probability and if one experiment did not afford some probability, twenty could not establish any." We are all inclined to look more favorably upon Stark's experiments when we are teaching human nutrition and wonder-

ing whether we should accept evidence from experiments with a million rats or one man. If we were considering scurvy as our subject we would certainly prefer Stark's evidence. Unfortunately, Stark never lived to celebrate his thirtieth birthday possibly because he had failed to learn and apply certain practical principles of nutrition detailed in stories about the great voyages.

THE INDIANS TEACH CARTIER TO CURE SCURVY IN 1535

The politician is usually accused of neglecting history in solving social problems. But no one can estimate the human suffering that has resulted from the failure of nutrition students during the past four hundred years to read the history of scurvy.

Scurvy was probably known to the ancient pathologists but it did not become an important disease until after the discovery of America. After 1492 many long voyages were undertaken for the purpose of discovering new lands and also for circumnavigating the globe. Many of these voyages lasted for two or three years. They really constituted experiments with men living upon very restricted diets for long periods.

The second voyage of Cartier led to the discovery of one of the first antiscorbutics. In December of 1535 while wintering near an Indian village in Quebec, Cartier's men began to die. The Indians of this village had already been dying of this disease in which "their legs became large and swollen, their sinews became black as coal." The "gums became so putrid that all the flesh fell away from them, even to the roots of the teeth, which almost all fell out."

Of a hundred and ten men there were barely ten that could help the sick and bury the dead under the snow. One of the dead was dissected. The heart was white, withered and surrounded by water. The liver seemed normal but the spleen looked as if it had been rubbed on a rough stone.

Captain Cartier became desperate thinking that all his men would perish. He went ashore and met an Indian whom he had seen afflicted with scurvy ten days before. The Indian seemed well and sent two women with the captain to secure branches of the tree used for curing the disease. Tea was made from the leaves and bark of this tree. Two of Cartier's men tried the tea. Their recovery was so miraculous that a whole tree was made into tea. The men were cured and the world had a new remedy for scurvy.

The tree used was probably an evergreen, possibly pine, which we now know to contain vitamin C. Dr. Leo Pariseau of Montreal has published an excellent summary of this discovery of Cartier in regard to scurvy.

Strange as it may seem, this discovery was given little recognition until modern times. Even today there are hundreds of men hunting and trapping in the north woods who live upon diets very low in vitamin C but make no use of the rich supply in the pine trees that surround them.

The voyages during the three centuries after the time of Cartier provide a fascinating literature for the armchair explorer. The danger of such voyages was probably due equally to destruction of vessels at sea and death from scurvy. Probably the greatest burial ground that the world has known for those dying of scurvy was in the neighborhood of the

Straits of Magellan. The long voyage from England to this southern part of South America provided ample time for the development of scurvy.

Only a few of these voyages can be mentioned but they will serve to show the disasters that resulted from the neglect of nutritional discoveries. In a report to the King of England concerning his privateering expedition against the Spaniards in 1588, Thomas Candish states, "In this place (Port Desire) we found an herbe called Scurvygrasse, which we fried with eggs, using traine oyle instead of butter. This herbe did so purge ye blood, that it tooke away all kind of swellings, of which many died, and restored us to perfect health." The Dutch sailors of this period are said to have made use of herbs on board their ships.

Lemon juice was carried on board ship to prevent scurvy as early as 1600. In April of that year Lancaster started down the Thames in February but did not really leave England until Easter. There were several ships in Lancaster's fleet. By the first of August many of the men were sick with scurvy in all the ships except the general's. Finally when they reached land in September the general had to send part of his men to help take the sick from the other vessels. They could not even lower their landing boats. Lancaster had performed an experiment in nutrition. He had brought bottled lemon juice, but for his ship only. Each man was given three spoonfuls per day as long as it lasted. "By this means the General cured many of his men and preserved the rest so that although his ship contained double the number of the rest yet he neither had so many sick nor lost so many men as the others."

When John Nieuhoff rounded the Cape of Good Hope in 1653 he had so many sick with scurvy that they could hardly navigate the boat. As soon as possible they went ashore and gathered mustard leaves and fed them to the crew, apparently with good results.

Anson, in his voyage around the earth (1740–44), lost a large per cent of his crew. They blamed the salt meat as many voyagers did before them. Finally they found an island with wild turnips, radishes, cresses, purslane, and sorrel. They had left England with 961 men and when the trip was about half over they had lost 526. They ate these greens as well as the acid fruits.

During Cook's voyages (1768–1779) the men suffered only slightly from scurvy epidemics because they carried lemon juice. Cook seemed to think that cocoanuts were excellent for treating scurvy although modern literature indicates they are low in vitamin C.

As a final voyage we can cite that of the *Jeanette* into the polar region sixty years ago. DeLong, the captain, was constantly worried about scurvy although he was free from it during his two years in the polar ice. DeLong's journal is especially interesting to nutrition students because he comments upon the rapid rate of union in a broken bone after one of his men had broken his arm. DeLong was familiar with some of the earlier reports of the failure of wounds to heal and bones to unite in cases of scurvy. The normal recovery of his man gave him evidence that the vitamin C requirement was being met. DeLong carried canned tomatoes among his antiscorbutics but some of his men suffered from lead poisoning due to the sealing of the cans with solder and the dissolving of lead in the juice.

These experiences on voyages demonstrate how quickly men can succumb to scurvy. Thus in 1721 a French ship sailed from China to Mexico in fifty days but all the crew except four or five died of scurvy. This is easy to understand when we realize that a large per cent of our poorer people get inadequate amounts of vitamin C. The sailors probably had incipient scurvy when they left land.

The voyages teach the merit of studying history. One can hardly believe that 200 years elapsed from the time that Lancaster protected his men from scurvy by means of lemon juice and the year 1795 when the British started to administer lime juice to their navy. The preservation of these antiscorbutics in the early 19th century was a difficult problem and many methods were tried before satisfactory ones were devised. From the problem of scurvy we will now approach another type of deficiency; namely, that caused by protein of poor quality.

A FRENCH ENGINEER INVENTS THE PRESSURE COOKER AND DISCOVERS GELATIN

Denys Papin (1647–1714?) was a mechanical genius who would feel very much at home in modern America. In the course of his life he invented a steam-engine, a new gun, and finally the autoclave or pressure cooker. At a very early date he became interested in the preservation of foods. When he came to England in 1675, he first devised his "digester" while in the laboratory of the great English chemist, Robert Boyle. This digester was the ancestor of all our modern autoclaves and pressure cookers. It even had a safety valve like that in use today. Later the digester was changed still more and became a steam-engine.

The discovery of gelatin is best described in Papin's own words written in his diary more than 200 years ago. "I took beef bones that had never been boiled but kept dry a long time, and of the hardest part of the leg: these being put into a little glass pot with water. Having pressed the fire until the drop of water would dry away in 3 seconds and 10 pressures I took off the fire and the vessels being cooled I found very good jelly in both my pots. . . .and having seasoned it with sugar and juice of lemons, I did eat it with much pleasure and found it as stomachical as if it had been jelly of hartshorn." These words were written about 250 years ago.

Gelatin was first advocated as a food for the poor. After Papin made his discovery of gelatin he attempted to interest the English King in it. Charles II was probably more interested in other matters such as keeping his own head on his shoulders, for he did not take to gelatin. The French, however, became interested. The magic of making a pound of dry gelatin into four hundred pounds of wet food by merely adding a little flavor and plenty of cheap water seems to have appealed to the French housewife. The delusion of gelatin was especially useful during the French Revolution when the supply of old horses had been consumed. Gelatin was made from the bones. It probably took the average citizen some time to discover that he had been eating considerable water but it may have expanded his stomach for a brief period.

During the reign of Napoleon the French continued to eat gelatin. For

nearly 30 years d'Arcet promoted the use of gelatin to replace meat in the diet of the poor. He maintained that "a box [of bone], a knife handle, a dozen buttons were so much soup stolen from the poor." There was much opposition, however, and many claimed gelatin had no food value. D'Arcet submitted the problem to the faculty of medicine of the University of Paris. Two questions were to be answered: (1) is gelatin nutritive and to what degree; and (2) is its use as a food healthful and not followed by any inconveniences?

The experiment of feeding gelatin to dogs was started about the time Napoleon was discovering that food was rather short in Russia (1812). After a few days upon a diet of gelatin, dogs refused to eat it and finally starved to death. In one experiment lasting three months dogs were maintained upon raw bones but failed when fed cooked bones. We now realize that these dogs were probably suffering both from the poor quality of the protein and from one or more vitamin deficiencies. Dogs fed egg albumen or fibrin also died. Even mixtures of the proteins failed.

Other purified constituents were then tried, such as fats, gluten, and starch. Much to the surprise of the authors, gluten maintained dogs for as much as three months. Such materials as cane sugar failed. These famous experiments were reported in 1816 by the eminent teacher of Claude Bernard, F. Magendie (1783–1855).

These experiments laid the basis for much of the modern work with vitamins. They proved that dogs could not live upon highly purified diets. They indicated that proteins differed in quality. Furthermore, they proved that the animal body, unlike leguminous plants, was incapable of fixing atmospheric nitrogen. It is hard to realize today that this ability of plants to fix nitrogen was firmly established at a somewhat later date, 1844. These experiments provided the first indication that a nutritional deficiency might lead to the changes in the eye that we now term xerophthalmia. All of these results were really the by-product of determining the nutritive value of gelatin.

These studies excited wide interest, especially after they appeared in the famous gelatin report of 1841. Oliver Wendell Holmes even wrote a humorous poem in honor of this study:

"No life worth naming ever comes to good,
If always nourished on the self same food,
The creeping mite may live so if he please,
And feed on Stilton till he turns to cheese,
But cool Magendie proves beyond a doubt,
If mammals try it, that their eyes drop out."

About the middle of the 19th century German scientists attacked the problem of why meat would support a dog while gelatin failed. At this date the chemical balance method was successfully employed. In other words, they made use of chemical analyses to account for the elements eaten by the animal and those wasted in the excreta. For the first time, about the middle of the past century, a physiologist, Bidder, and a chemist, Schmidt, were able to account for all the nitrogen eaten in the food by that excreted in the urine and feces. This provided the final evidence that the body did not take the nitrogen from the air and build it into body tissues, but it did not explain the failure of gelatin in contrast to meat proteins.

Other Germans followed this line of attack. They soon found that gelatin

was digested and absorbed by the body but that a dog could not be maintained upon it alone. They even discovered that gelatin could replace part of the meat protein needed to maintain a dog. Thus we have the beginning of the idea that proteins can supplement each other.

Even while Magendie was making his early studies and while Napoleon was trying to conquer Europe, the first amino-acids were being isolated. The first inkling that amino-acids had something to do with nutrition did not come until 1876. Again gelatin was responsible for the investigation. In that year a young Swiss physician, Escher, announced that gelatin was a much better food for dogs when supplemented with the amino-acid, tyrosine. From 1876 on, an increasing number of studies indicated that food nitrogen alone was not sufficient but that part of this food nitrogen must be in the form of essential amino-acids. Escher's work lies entombed in a small, local journal of natural science so it has been almost forgotten.

While gelatin is a rather lowly form of protein, its shortcomings are those of omission. Due to its very deficiencies, it has stimulated research that has provided some of the greatest discoveries in nutrition and biochemistry.

A FRENCH MINERALOGIST BECOMES A FARMER

The inorganic elements represent another special field of nutritional deficiencies. In an age of great chemists, one stands out for his many contributions to nutrition—the French scholar, J. B. Boussingault (1802–1887). In the year 1822 he went to South America to prospect for a British mining company and there he discovered a deposit of platinum. Of far more importance, however, was his observation that certain villagers ate iodized salt and were free from goiter while others ate ordinary salt and were afflicted. Not only did this young chemist point out the importance of iodized salt but he devised analytical methods for determining the amount of iodine. Furthermore, he suggested that the level be kept low to avoid toxicity. It was almost a hundred years from the time of Boussingault's observations before iodized salt was again used extensively in the prevention of goiter.

When Boussingault returned to France from South America, he married a young woman who owned a farm in Eastern France. This became one of the first experiment stations. It was here that Boussingault first ran chemical balance studies upon animals. It was here that he discovered how essential calcium was in the diet of his animals. He even analyzed the water and found an adult horse could secure part of its requirement of calcium in this way.

Boussingault attempted to run the first complete nitrogen balances upon animals about a hundred years ago. He failed because of the loss of nitrogen from his samples before they were analyzed. At about the same time that Boussingault was running balance studies upon his animals he was making similar studies with plants. For the first time he proved that legumes, such as clover, could utilize the nitrogen of the air while cereals such as oats could not. Thus nearly a hundred years ago chemical balances were being used to study proteins and the calcium requirements of animals were being de-

termined just as they are today. As in the case of vitamin C and scurvy, one can only speculate about the suffering caused through the general neglect of Boussingault's observations concerning iodized salt, and the need for calcium in the diet.

BONES AND HOW THEY GROW

Throughout the years no field of nutrition has received more attention than that which concerns the formation of the bones. To the layman the bones seem like solid, fixed structures that are subject to little change. To the biochemist they are ever-changing. In that period of life when the animal is young and growing the bones also are growing. In fact, the bones seem to have an ability to grow that exceeds that of most parts of the body. When a young animal is partly starved, its bones continue to grow when other organs such as the heart and kidneys stop. When the animal body ages, we all know that the bones also age and become brittle and fragile.

One of the earliest students of bone growth was Stephen Hales (1677–1761). This British clergyman was one of the leading vivisectionists of his time. He preached on Sundays about the greatness of God as manifested in the physiology of his plants and animals. On week-days he learned the secrets of this physiology. All of us would like to have heard some of these sermons because Hales was a great scientist. In studying bones he desired to learn whether they grew from the ends or the middle. He drilled two holes in the bones of the legs of young chickens. He then measured the distance between these holes when the chicks were young and after they were well grown. He found that the distance between the holes did not change. Therefore he concluded that bones grow from the ends.

A useful method for studying the growth of bones was also discovered during the lifetime of Hales about 200 years ago. In 1736 an English surgeon, John Belchier, was eating dinner with a cotton printer. He observed that the bones of the pork served for dinner were red. Naturally this interested the surgeon and he was surprised to learn that the swine had been fed some of the madder used in dyeing the cloth. The surgeon later reported this discovery and madder became one of the useful tools for studying the growth of bone, due to its property of being laid down in the bone as the new bone is formed.

The chemical composition of bone and teeth was quite well established by the time of the Declaration of Independence in America. About this time oxalate came into use for the precipitation of calcium and a good analytical procedure was available. By the year 1799 the statement of the modern text became common; namely, that bone was composed chiefly of calcium phosphate with traces of calcium carbonate and with small amounts of such other constituents as sulfur. The organic constituents of bone had long been recognized in the preparation of gelatin.

The chemical tables of John which appeared in 1816 included many bone analyses. Nearly a hundred years ago von Bibra in 1844 published a whole book upon the composition of bones and teeth.

In spite of the recognition of the composition of bone 150 years ago, the origin

of its calcium was not established until the early part of the past century by Boussingault and his contemporaries. As late as 1799 one of the famous French chemists published a paper about chemical balances in laying hens. He found that hens lost more calcium from their bodies in the form of egg-shell and in the feces than they ingested in their food. He concluded that this was evidence for the change of some other element into calcium. He forgot that the bones provided a storehouse of calcium which could be withdrawn during such emergencies as laying eggs and secreting milk.

The true origin of bone calcium was discovered about 100 years ago. In 1822 the great English biochemist, Prout (1786–1850), found that the bones of the developing chick were built from the calcium of the egg-shell. By 1843 the French chemist, Boussingault, had recognized the great need for calcium in the diet. He ascribed the dirt-eating habits of animals and people to this craving for calcium when it was deficient in the bones and in food.

The study of the history of bones and their growth is an immense field in itself since it encompasses the literature of rickets and this in turn leads to the vitamin field. These must be neglected at this time.

Two final examples may illustrate the many by-paths that confront the student in this field. The following quotation sounds quite modern, "Hence physicians and surgeons should be cautious how they apply strong acids to the bones and teeth. Such acids used in the way of a dentrifice with design to render the teeth white and glossy, may soon render the person melancholy, nervous or paralytic." This is quoted from the translation of Boerhaave's chemistry which appeared during the time of George Washington.

A final story makes one wonder what is new, even in nutrition. In 1870 a French worker, Papillon, attempted to make rats and pigeons build their bones out of magnesium and aluminum instead of calcium. Jockeys and aviators today would probably appreciate having bones of such light elements as these. Papillon found he could modify the composition of the bone to a slight degree when he replaced the calcium of the diet with magnesium or aluminum. The interesting part of his discovery, however, was the convulsions which appeared in the rat when its diet was deficient in magnesium. On the other hand, the rat fed magnesium phosphate remained normal for two months. Within recent years these findings have been rediscovered but Papillon and his work have remained buried in the past.

These are but glimpses of the vast background in nutrition that has been constructed during the past seven centuries. The literature of this period probably contains many discoveries that were made laboriously but will remain lost unless they are unearthed and brought into the service of the modern world. The old literature may still hold facts of great importance to human welfare if we have patience to study the literature and open minds to recognize these facts when we see them.

THE SITE OF ACTION OF FOUR WATER-SOLUBLE VITAMINS[1]

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A DIETITIAN'S work is much the same as that of a stationary engineer. The stationary engineer is in charge of a power plant. He must feed this plant with fuel used as a source of energy, and while the plant is operating must keep it in repair by replacing parts.

The dietitian's job is more complex as she must feed fuel to a number of temperamental power plants, which when properly fed increase in size up to a more or less variable limit, and at the same time continually replace their wear and tear.

The engineer's problems vary with the type of power plant he operates. A well designed plant may operate poorly because it is improperly maintained, while a poorly built and designed plant may operate quite well because of the special care in properly adjusting each of its parts. The poorly fed power plant will frequently be out of commission, its fuel will burn with much smoke and much power will be lost in the squeaks and rumble of its machinery.

In the same way the dietitian's power plants may have been born to be strong and healthy, more or less indifferent, or weak and sickly. And finally, because of over-indulgence or the after effect of acute disease, the problem of maintenance will become more complex, just as with the engineer. As an example—the individual who over-indulges in carbohydrates for years is apt to wear out the pancreas reserve prematurely, so that insulin must be administered to make it possible to burn carbohydrates. Other examples are the weakness and lack of endurance of the individual who consumes too little vitamin C, the pain and discomfort of the individual who consumes an insufficient quantity of vitamins B, the dermatitis following the consumption of inadequate quantities of nicotinic acid, and last and most common the vague symptoms when all of these are consumed in subminimal quantities over a long period of time.

Such conditions as these are directly comparable to the power plant which operates with improper fuel, poor lubricants and loose bearings. Such a dilapidated plant runs to an extent, but produces squeaks, knocks, and groans, and showers the community with a bad odor from its smoke-stack.

There is one problem which is common to all types of power plants, and that is respiration. Respiration is essentially the utilization of molecular oxygen for the oxidation of organic material (metabolites). The method of oxidation in the furnace of the engineer's power-house is comparatively simple, as at the temperatures present the organic material and oxygen unite directly to produce energy in the form of heat. It is not quite this simple with the dietitian's power plant. At first it was thought all that was necessary to effect oxidation in the body was to activate the oxygen absorbed by

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breathing. The activated oxygen was supposed to burn the body metabolites readily, thus producing energy.

After it was found that active oxygen by itself was inadequate to account for the respiratory process, the so-called "hydrogen activation hypothesis" was developed. According to this hypothesis the essential thing is the activation of the substance to be oxidized in such a way that certain hydrogen atoms within their molecules become labile and capable of removal by a suitable oxidizing agent. This hypothesis led to the discovery of a whole series of intracellular enzymes, the dehydrogenases, with precisely this function. These enzymes form an essential part of the respiratory mechanism. They are specific, and different organic metabolites are activated by different dehydrogenases.

An example of such a system is the oxidation of aldehydes and purines by the milk dehydrogenases. Other dehydrogenase systems cannot react directly with oxygen, and the oxidation can only be effected by certain highly specialized substances.

The inability of most of the metabolites, when activated by their dehydrogenases, to react with molecular oxygen, led to the "hydrogen-activation and oxygen-activation hypothesis". As the name implies, we have active hydrogen reacting with active oxygen. It was soon seen that this alone could not account for respiration and it was found that the active hydrogen could only react to active oxygen when a go-between or hydrogen carrier was present to carry the hydrogen to the oxygen. Respiration is now explained on a hydrogen-activation, hydrogen-carrier, oxygen-activation basis.

In biology different types of carrier systems have been recognized. The simplest system consists of substrates A and B which cannot react with one another unless an additional substance C is present. C is always a substance which can exist in oxidized and reduced forms, such that the oxidized form is readily reduced by A and the resulting reduced form readily oxidized by B. The substance C is said to be a carrier between the systems A and B, and its action is due to its alternate oxidation and reduction by substrates A and B respectively. This reaction is written as follows:

$$AH_2 + C = A + CH_2$$

$$CH_2 + B = C + BH_2$$

It is read thus: Substrate A activated by its enzyme dehydrogenase reacts with its carrier C to form reduced carrier C plus oxidized substrate A. Reduced carrier C plus substrate B activated by its oxidase reacts to form oxidized carrier C plus reduced substrate B. The carrier thus reacts with activated A at one enzyme and passes to enzyme-activated B, thus bridging the gap between A and B.

Thus far six carriers and one dehydrogenase carrier system have been identified and are as follows: 1—Glutathione, 2—Cytochrome (A-B-C), 3—Flavoprotein, 4—Coenzyme II, 5—Coenzyme I, 6—Ascorbic Acid, and 7—Dehydrogenase Carrier System.

1—Glutathione. This simple organic tripeptide isolated by Hopkins is formed from one molecule each of glutamic acid, glycine and cysteine. The group of interest from our present point of view is the SH group of cysteine.

The reduced form in the presence of

traces of iron or copper is auto-oxidizable, *i.e.* it will hand its hydrogen on to molecular oxygen, itself becoming oxidized.

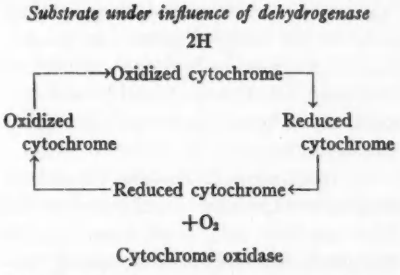
Glutathione can thus become a part of the hydrogen transport machinery of the cell. We have but little information in which hydrogen donators are particularly concerned. It is thought to account for not over 10 per cent of the respiration of most animal tissues. It is concerned with the oxidation of certain unsaturated fatty acids and unidentified substances in liver.

2—Cytochrome (1) is a carrier which accounts for more cell respiration than does glutathione. It is a constituent of a great many living cells. The nerve fibers contain very little of it, while the brain cortex contains a great deal. The part of these cells containing the nucleus is rich in cytochrome, while the nerve fibers, elongated processes of the nerve cell, contain very little.

Cytochrome is an iron-containing pigment allied to haem. This pigment combined with globin constitutes haemoglobin. Haem can combine with different proteins and all sorts of nitrogenous bases (*i.e.* pyridine or nicotine).

The pigment portion of cytochrome is probably haem, or a closely allied substance, combined with a colloid, probably a protein, and is classed as a haemochromagen. It is identified by the fact that it has a characteristic absorption spectrum. Thus far the absorption spectrum separates cytochrome's three components, A-B-C, which are found associated together. Some tissues contain more of one form than the others. Cytochrome can be actively reduced and oxidized. It can accept hydrogen from a hydrogen donator and give it up again to molecular oxygen.

The acceptance of hydrogen by the cytochrome involves an actual change in the valency of the iron atom of the molecule, for in the reduced cytochrome the iron is in the divalent or "ferrous" state, while in oxidized cytochrome it is trivalent or "ferric" iron. Cytochrome can be actively reduced and oxidized, that is, it receives oxygen and parts with it again. Both processes are catalyzed by enzymes and do not normally take place in the absence of enzymes. The enzymes responsible for the reduction of cytochrome are called dehydrogenases. They attack the substrate undergoing oxidation in such a way that one or more hydrogen ions are able to transfer themselves to the cytochrome or to any other available hydrogen acceptor. The reduced cytochrome is oxidized by molecular oxygen, the hydrogen forming water, and the oxidized cytochrome is ready to react with more substrate as indicated below.



The cytochrome system is very active in the oxidation of succinic acid and of glycerophosphate.

3—Flavoprotein (2). The prosthetic group combined with a protein in this case is a flavin having the formula $C_{17}H_{20}N_4O_6$. This substance has been shown to be identical with vitamin B_2

(lactoflavin or riboflavin). It is united to a protein through a phosphoric acid radical. Flavoprotein is capable of being reversibly oxidized and reduced. The oxidation of the reduced form takes place in the presence of molecular oxygen without the help of an enzyme. On the other hand it is not reduced by the dehydrogenase systems of the tissues without the aid of an intermediary known as Coenzyme I and II.

4—Coenzyme II (Warburg) has been isolated and studied and found to be composed of one molecule of adenine, one of nicotinamide (pellagra-preventive factor), three molecules of phosphoric acid and two of pentose. Coenzyme II acts with hexosemonophosphate dehydrogenase.

5—Coenzyme I (Warburg) acts with the hexosediphosphate, alcohol and muscle lactic acid dehydrogenase. It differs from coenzyme II in that it has only two phosphoric acid groups.

6—Ascorbic Acid (3) has the formula $C_6H_8O_6$. It is a powerful reducing agent and in the presence of glutathione cannot exist in the oxidized form. At present it is considered a hydrogen carrier of unknown substrate. Ascorbic acid oxidases have been found thus far only in plant tissues.

7—Dehydrogenase Systems (4) act as respiratory carriers. In this system we have succinic acid acted upon by the succinate-dehydrogenase liberating two hydrogen ions, forming fumaric acid. The fumaric acid, or oxidized form of succinic acid, can be reduced by another dehydrogenase system.

TYPES OF RESPIRATORY SYSTEMS

According to Hopkins and co-workers (5), the simplest type may be represented symbolically as follows:

Type I

Substrate—O_2
Dehydrogenase

This means that the substrate (activated by its dehydrogenase) can react directly with molecular oxygen, and *no carrier is necessary*. An example of this type is the dehydrogenase of milk which brings about the oxidation of purines.

Type II

Substrate—C—O_2
Dehydrogenase

This type in the most part is artificial in that C is a dye, such as methylene blue, whose reduced form is readily oxidized by molecular O_2.

Type III

Substrate—cytochrome C—O_2
Dehydrogenase Oxidase

This differs from Type II in that cytochrome C, the carrier, cannot be oxidized by molecular oxygen but requires an oxidase to accomplish it. This system (6) carries on almost the whole of respiration of baker's yeast. In animal tissues it plays an important part in that it is typical of the dehydrogenase of succinic and glycerophosphoric acid. The majority of known dehydrogenases react through other mechanisms.

Type IV

Substrate—Coenzyme I (or II)—Flavo-
Dehydrogenase protein—O_2

This chain of reaction was demonstrated by the Warburg (7) school. Each link can only react with its immediate neighbor and not with any of the other links in the chain. The activated substance is not oxidized by oxygen or even by flavoprotein but only by coenzyme. The

reduced coenzyme is not oxidized by oxygen but only by flavoprotein. The reduced flavoprotein is oxidized by molecular oxygen. Enzyme action is only involved in the first stage so that in the rest of the chain the problem of specificity resolves itself into a purely chemical one.

Type V

Substrate—Coenzyme I (or II)—Flavo-Dehydrogenase

protein—Cytochrome C—O_2

Oxidase

According to Theorell (8), flavoprotein is necessary because the coenzyme cannot reduce the cytochrome. All of the known dehydrogenases seem to react in one or another of the ways mentioned. The dehydrogenases fall into four classes according to the way they react with oxygen, cytochrome, coenzyme I or II. There appears to be no overlapping between the classes. A dehydrogenase which reacts with oxygen reduces cytochrome very slowly and does not react through coenzymes. One which reacts with cytochrome does not react with oxygen either directly or through coenzymes. Those which react through coenzymes react neither with oxygen nor cytochrome and finally the two coenzymes are not interchangeable.

An oxygen-activating catalase is only needed when cytochrome is involved, whereas activation of the substrate is indispensable.

In types I, II, and IV the oxygen molecule acts as a direct "hydrogen acceptor". In all these cases the oxygen is reduced to hydrogen peroxide which is often used up in secondary reactions. Only in the cytochrome system does it appear that the H_2O_2 is not formed.

Type VI

$Substrate_1$—Coenzyme I (or II)—$Dehydrogenase_1$

$Substrate_2$—Cytochrome C—O_2

$Dehydrogenase_2$

Oxidase

Here we see that $substrate_2$ (succinate) is oxidized to fumerate by cytochrome C, and the fumerate oxidizes the ultimate substrate through coenzyme I. Szent-Györgyi (9) believes this reaction of great importance and that in muscle it accounts for the bulk of the respiration.

Thus far we have talked only about the hydrogen portion of the body metabolites. There is less known about the carbon. The enzyme, carboxylase, with the function of splitting carboxyl groups from organic acids, has been known for a long time.

Substrate—Co-carboxylase = CO_2

Carboxylase (vit. B_1 pyrophosphate)

In order for most carboxylases to complete the splitting of COOH to CO_2, a co-carboxylase is necessary. Recently an important co-carboxylase has been isolated in pure crystalline form by Lohmann and Schuster (10). It proved to be thiamin-pyrophosphate, in other words, vitamin B_1 pyrophosphate. All of these oxidation and reduction systems have been shown to take place in animal tissues.

Sites of reaction of several of the vitamins (B_1, B_2, PP factor (?), ascorbic acid) have been demonstrated. These vitamins are active groups of dehydrogenases and co-carboxylase and probably exist for optimal cell function in definite proportions and concentrations. We have previously shown that animals whose cell equilibrium has been altered by depletion of the B complex (B_1 or B_2) while nurs-

lings, fail to learn a standardized (Carr) maze as readily as normally fed animals. In this incidence the maze proved to be a reliable instrument for demonstrating changes in an animal brought about by early altered nutrition. Knowing that these vitamins are associated with the proper maintenance and function of the nervous as well as other tissue, and that the nervous tissue has to do with learning, we are justified in concluding that the maze as used is an instrument which tests a physiological activity of the nervous system.

As depletion of the brain cells of certain dehydrogenase and co-carboxylase systems retards the physiological activity of the cell, we now wish to ascertain the effect of increasing certain dehydrogenases. In so doing the normal chain of cellular respiratory reactions may be interfered with to the extent of altering the physiological activity of the cells concerned. Vitamin C, that is, ascorbic acid, was chosen at this time because of its availability. The brain tissue contains this vitamin in quite large quantities. The brain content is increased when the vitamin in the diet is abundant and decreases when it is sparse. The brain has the capacity to store vitamin C in quite large amounts while food substance such as glucose is stored in small quantities only.

At present we are injecting daily, 5 days a week, 100 mg. of ascorbic acid into rats that are being tested on a standard Carr maze. Thus far this group of rats has been markedly retarded in learning the maze. I would like to point out that this dosage injected into the rat would be equivalent to about 40 gm. in a person weighing 60 kg. It is quite impossible for adults or children to consume such quantities using natural food as a source of the vitamins.

The availability of some of the water-soluble vitamins has made it possible to saturate or in some instances supersaturate individuals and observe any clinical changes in behavior.

We first saturated patients suffering psychogenic psychoses with ascorbic acid by feeding 1 to 3 gm. daily. When the spinal fluid ascorbic acid content was near the maximum obtainable with the technic used, many highly excited patients (active 24 hours daily) had periods of quiet each day. These periods were usually at night. The quieting of these patients suggested that their excitement, at least in part, was due to a deficiency of ascorbic acid in the nervous system.

The ascorbic acid concentration of the cells parallels in a general way their intensity of respiration. Some of the patients, while undergoing saturation with ascorbic acid, had their symptoms intensified. This might be accounted for in certain patients by an intracellular imbalance in the enzymes and coenzymes of the oxidation and reduction system. It is now within our power to alter the balance, at least to some degree, of some of the enzyme and coenzymes present in the cell. This is demonstrated in the *in vitro* experiments of Gavrilescu and coworkers (11) and subsequent experiments, all of which show that increased uptake of oxygen in the vitamin B_1 deficient brain is dependent upon the vitamin B_1 present. Another such instance is shown by Warburg, Christian and Griest (7), who isolated a coenzyme responsible for the dehydrogenation of hexosemonophosphate, a product produced during the intracellular metabolism of glucose. This coenzyme under

hydrolysis yielded among other products nicotinic acid-amide, now known to be the pellagra-preventive factor. Judging from the diets consumed by the insane, partial deficiencies of all or any of the vitamins should be common. With these facts in mind we attempted to saturate the patients who were not benefited by ascorbic acid alone, with other vitamins, thus hoping to return the unbalanced oxidation and reduction system to normal.

We thus saturated patients suffering psychogenic psychoses, first with ascorbic acid, then, while maintaining ascorbic acid saturation, we attempted saturation with thiamin-hydrochloride; and third, while maintaining a high degree of saturation with the two former vitamins, we attempted to saturate the patients with nocotinic acid.

We so treated 17 chronically disturbed and untidy patients. Because of their combativeness they were known as the most difficult patients in the institution. We were able by simple saturation of the patients with these three vitamins to obtain a marked improvement in behavior of over half the group.

These observations and facts presented, indicate that certain pathological states, including some psychogenic psychoses, are dependent at least in part upon an imbalance of intracellular metabolism. The symptoms produced will vary, depending upon the groups of cells and the organs depleted. They further will vary, according to the place in the chain of intracellular metabolic reactions where the relative lack of enzyme and coenzyme exists. If certain groups of cells of the central nervous system are depleted of enzymes and coenzymes, then the symptoms might be hallucinosis, pain, tremors, excitement, depression and perhaps others.

I have discussed the site of action in the cells of vitamins C, B_1, B_2 and nicotinic acid. These compounds must be supplied in the diet as the human body is unable to synthesize them. They occur in nature in different foodstuffs and because of early training, temperament, pure cussedness or organic changes, too frequently are consumed in inadequate quantities to maintain good health.

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THE METABOLISM OF CALCIUM AND PHOSPHORUS[1]

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IT IS not my purpose in this discussion to place so much emphasis on calcium and phosphorus in relation to the technical aspects of dietetic practice but rather to discuss their physiological importance. It has been a rather difficult task to establish these two substances in their proper category as mobile active factors in biological processes rather than as inert, fixed components of bones and teeth. However, today such facts are generally accepted. Equally slowly was the fact established that they are quite as important in adult life as in the growing organism.

The skeletal structures, in addition to their supporting rôle, serve as a mobile reservoir of both calcium and phosphorus. The content may be reduced or increased, according to circumstances.

Examples of the more extreme changes are seen in such diseases as osteomalacia and osteoporosis, and in the hypocalcia of pregnancy. It is probably true, however, that the physiologically mobile salts reside mainly in the trabeculae and that the cortex of bone is relatively stable. The evidence for this latter conclusion lies in an observation by Clark and Mrgudich on bones of rats supplied from my laboratory. The x-ray diffraction patterns of bones that had developed on an optimal diet showed a definite pattern, presumably dependent upon the molecular configuration of the constituents. But the bones of rats that had been rendered severely rachitic and then healed showed a very different pattern, indicating that the molecular pattern was very different from normal bone. This difference was found only in the cortex. Whether the new bone was physiologically inferior has not been determined. There appears to be some evidence, however, that such bones are more susceptible to the decalcifying action of excess amounts of vitamin D. Whether the salts in cortical bone are in a form differing from that in trabecular bone is unknown.

In the animal body, aside from that in the bones and teeth, there is considerable calcium present in the soft tissues as inorganic salts, most abundantly as primary and secondary calcium phosphates. Phosphorus occurs in soft tissues in various forms as derivatives of phosphoric acid, such as phosphates, lecithin, nucleic acid or phosphoprotein.

In starvation both calcium and phosphorus continue to be excreted long after the supplies in the soft tissues are greatly reduced. One apparent exception to this is found in the dental enamel. Since there is no circulation in this structure it is very difficult to see how the calcium can be mobile, but the question is still unsettled.

Before birth the fetus obtains calcium and phosphorus from the mother's

[1] Read before the Annual Meeting, Illinois Dietetic Association, Manteno State Hospital, Manteno, Illinois, February 11, 1939.

Numerous reviews and monographs have furnished the data upon which this article is based. The author makes no claim to originality but it is impossible to cite all of the literature involved in such a condensation without preempting an unreasonably large amount of space.

diet, or if that is deficient, from her bones. One investigator has found that during the first four months of life the fetus requires daily an average of 3.4 mg. of calcium; during the fifth month, 59; fifth to seventh months, 62; eighth month, 60; and ninth month, 455. From this it is apparent that the mother's demand for calcium is greater toward the end of pregnancy. While similar studies of phosphorus requirement have not been made it is apparent that the increased phosphorus demand must begin much earlier in fetal life because of the greater need in developing soft tissues. It follows from these observations that the pregnant mother is likely to be in negative calcium-phosphorus balance during much of the period of pregnancy and of lactation as well.

During the growth period of a child the demands of calcium and phosphorus are heaviest, hence dietary deficiencies are more likely to occur. Diets that would be adequate for an adult may lead to grave disturbances of health in the child. Very commonly children are not given the benefit of adaptation of their diets to the special needs of a particular growth period but are required to eat diets which, while entirely adequate for adult members of the family, are very deficient for the child.

Both animals and human subjects on diets deficient in calcium and phosphorus sometimes display abnormal cravings for dirt, bones, egg shells, and similar substances, in an instinctive effort to correct the deficiency. The most common manifestation of calcium-phosphorus deficiency is failure to grow at a normal rate, and a generally unhealthy aspect. In addition to gross changes in the skeleton there are often muscular paralyses and other disturbances of soft tissues.

Mature individuals on a calcium-phosphorus deficient diet usually reproduce and lactate normally until the loss of calcium exceeds by 20 per cent the total intake. After that a variety of disturbances may occur.

While we have too little exact information on the calcium-phosphorus requirements of the adult human, it seems probable that a daily intake of 1 gm. of calcium with from 1 to 1.2 gm. of phosphorus would be an optimum intake with an adequate safety factor for both elements in the average human being. For a growing child, of course, the requirements are higher. Most pediatricians are inclined to the view that at least one quart of milk a day would be necessary to supply the requirements.

In the female, so far as we can determine at present, menstruation imposes no additional requirement of either calcium or phosphorus. Pregnancy and lactation, however, do impose additional demands.

In general, other things being optimal, the daily caloric consumption is directly correlated with the daily intake of calcium and phosphorus. But if the diet does not contain nucleoprotein in optimal amounts this relationship will no longer hold, especially with regard to phosphorus. A diet of patent flour, degermed corn meal, sugar and fats, even though the total protein content is high, must be supplemented with milk and eggs, even for an adult. On the other hand, high meat diets are

nearly always deficient in calcium, especially when supplemented by purified carbohydrate and fat preparations.

FACTORS GOVERNING ABSORPTION

The actual source of mineral elements in the diet is of little importance provided the material is nontoxic and may be rendered soluble for absorption in the gut. Calcium and phosphorus are absorbed directly into the blood stream for it has been demonstrated that ingestion promptly increases the concentration of each in the blood.

Absorption is governed by: the hydrogen-ion concentration in the gut; other constituents in the diet; the vitamin D content; and the bile.

Calcium, to be absorbed in the small intestine, must be in solution. Many forms are readily soluble only in acid media; in the stomach, for example, in ionized solution. With increasing alkalinity and as the material proceeds through the intestine, tertiary calcium phosphate and carbonate are precipitated and fatty acids combine to form insoluble calcium soaps. Under normal conditions acidity persists in most of the small intestine for long periods after a meal. Any deficiency in hydrochloric acid in the stomach should result in lessened calcium absorption, but this factor is not usually of great practical importance as we shall see.

Carbohydrates that are easily hydrolysed and rapidly absorbed have little influence on calcium absorption. Those not rapidly disposed of, such as lactose, favor such absorption presumably because they favor the development of an acid medium in the intestine.

Foods such as beef, pork and wheat stimulate the production of greater alkalinity in the intestine and so tend to decrease absorption.

Fats in general tend to inhibit absorption, partly mechanically and partly by forming calcium soaps. Any factors altering the proportion of calcium and phosphorus ions necessary for the optimum production of soluble calcium phosphates will inhibit absorption. This is probably offset to some extent by increased bile flow. Excess of phosphorus, alone, will result in the formation of the relatively insoluble, tertiary calcium phosphate. Excess amounts of magnesium and of potassium will, to a less extent, inhibit absorption in the same way, while chlorine tends to augment the process.

Cereal diets seem to affect unfavorably the absorption of calcium because the phosphorus content of cereals is in a form not easily rendered soluble and so upsets the ion balance in another direction.

Vegetables are often not so completely masticated as other foods, especially by children; thus the calcium and phosphorus are not so completely liberated, and a certain amount is lost.

An excess of calcium over phosphorus in the diet means that all of the phosphorus will be combined with calcium and thus none will be available for the formation of numerous other essential phosphorus compounds. This will not necessarily interfere with absorption but ultimately does have a similar effect.

A deficiency in vitamin D results in a negative calcium and phosphorus balance. Adequate vitamin D restores this balance. It was first supposed that this was due to increased permeability of the

intestine to calcium, but this explanation does not cover all the facts now known. This phase of the problem at present is difficult to elucidate, but it seems fairly certain that the action of vitamin D does not have to do primarily with increased absorption of these substances from the intestine, but rather with decreased excretion into the intestine.

Bile is an important agent in promoting the absorption of vitamin D itself. It is apparent also that bile directly facilitates the absorption of calcium but the mechanism whereby this is effected is not clear.

The next important question is the fate of these elements after they enter the blood, where in most species calcium is present only in the plasma. The amounts in serum and plasma differ but little, ranging from 9 to 12 mg. per 100 cc. of fluid in the human. The ranges are greater in the dog and still greater in other species. Calcium exists in at least two forms, possibly three. The non-diffusible form makes up a little less than 50 per cent of the total in human blood and is mainly in combination with the serum albumin. The rest apparently is in a colloidal calcium phosphate, the exact nature and significance of which is not known, except that it does not appear unless the calcium concentration is increased considerably. It is believed that the ionized calcium is the important physiological form.

Phosphorus is present in the blood in a number of combinations. Something less than half of the total amount is present in the corpuscles. Of the forms present, the inorganic, a mixture of soluble primary and secondary phosphates, is probably of most importance physiologically. These function in the maintenance of acid-base equilibrium, in carbohydrate metabolism, in the transport of alkali earth elements and in the absorption of fat and carbohydrate.

During starvation for long periods both of these elements are maintained at fairly constant levels in the blood and continue to be excreted.

CONTROLLING MECHANISMS IN CALCIUM-PHOSPHORUS METABOLISM

There are several physiological factors involved in the metabolism of these elements, the most obvious of which is the parathyroid. Closely related to this is vitamin D. The mechanism most immediately active is the reaction of the blood and body fluids, a higher hydrogen-ion concentration causing greater solution and ionization. Also, and very imperfectly understood, is the obvious effect of the autonomic nervous system. It is not apparent whether this is mediated wholly or in part through some other mechanism or is a direct effect of nervous impulses on tissue cells such as the liver.

Further, there is an obvious influence of enzymes on local tissues. Phosphatase is well recognized as one of the members of this system. Calcium is present in blood in concentration greater than is possible in water. Some of the calcium is bound by protein and this compound is not ionized. Tissue fluid also contains about the same concentration of calcium but much less protein. Here the carbon dioxide tension is much higher than in the blood, therefore the ionization of calcium must be much greater. In a less active tissue, however,

such as cartilage, the carbon dioxide tension becomes much less and calcium is deposited. One theory is that the deposition first takes place as a calcium-protein complex that unites with phosphate to decompose finally into a calcium-phosphate-carbonate complex, liberating the protein to be used again. Another theory, now severely criticized, is that deposition of calcium in bone takes place as a secretion from osteoblasts. A third theory is that phosphatase is secreted by osteoblasts which break up the organic phosphates of the blood, causing a local increase in the concentration of phosphate. This finally exceeds the limit of solubility of calcium, which is then deposited.

It must be emphasized, however, that none of these theories adequately explains how the parathyroid hormone and vitamin D come into the picture.

THE THYROIDS

Hyperthyroid states in the human increase calcium excretion but do not increase the blood calcium concentration. The increased excretion does not bear any direct relation to the increased heat production. Similar results have been found in normal subjects, both human and animal, when thyroid was administered in any form.

In hypofunction of the thyroid, as in myxedema, calcium excretion is low and is increased by administration of thyroid. The high calcium excretion occurring in such hyperthyroid states, as Graves' disease, is reduced by treatment with iodine.

Along with increased calcium excretion there is increased phosphorus excretion, suggesting that the extra calcium comes from the bones. This is in accord with the frequent observation of osteoporosis in Graves' disease.

This effect is certainly not due to stimulation of the parathyroid, otherwise the blood calcium concentration would be increased. The mechanism of this effect must remain unexplained for the present. However, these observations show clearly that the thyroid does play a large part in the metabolism of calcium and phosphorus. Until these observations were made it could not be stated with certainty whether the commonly observed dental defects in thyroid disturbances were of specific nature or were secondary effects of a general state of impaired nutrition. It now appears that there is some specific relationship.

Thyroidectomy in experimental animals causes retarded eruption and small teeth, as well as furrowed enamel. In human cretins there are irregularities of both jaws and teeth, delayed eruption and high incidence of caries. Hyperthyroid conditions in children frequently result in accelerated growth of teeth of excellent quality but in prolonged conditions of this nature the gums are edematous, hyperemic, and bleed easily.

THE PARATHYROIDS

Despite the intimacy of embryologic origin, there does not seem to be a very close functional relationship between the thyroid and parathyroid except in the mechanical fact that injuries to the one may easily involve the other. For 45 years after the first description of these bodies by Sundstroem in 1880 the known facts about these minute bodies were that their absence or impaired function caused death by tetanic convulsions and that this was associated with a disturbance in calcium-phosphorus metab-

olism, the exact nature of which was not very well understood.

In 1924, an active extract of these organs was prepared which would, for a time, completely protect an animal or human subject from whom the parathyroids had been removed. The extract, administered to normal subjects, increases the blood calcium and phosphorus concentrations and also increases the excretion of both. Administered to parathyroid-deficient subjects who are showing decreased excretion of both calcium and phosphorus, and decreased concentration of blood calcium, it will restore the normal proportions in the blood and the normal rate of excretion, and protect against the tetanic seizures so commonly fatal.

After a period of such treatment, the parathyroid-deficient subject usually becomes adapted in such a way that continued administration is unnecessary. Such a subject is now said to be in latent tetany, a condition of impaired calcium-phosphorus metabolism of less severity than that necessary to produce actual tetany. However, the factor of safety has been reduced so that minor influences may now induce tetany and even death.

Long continued administration of the extract, however, frequently renders subjects tolerant to its influence so that it is no longer an effective agent. When this occurs, highly concentrated preparations of vitamin D will restore such subjects to a normal state and maintain them so for a period of years. Since this is possible after most of the parathyroid tissue has been removed, it is obvious that the effect is not due to parathyroid stimulation. And, since the thyroid is also usually absent in such conditions, it is further obvious that it cannot be a direct effect on the thyroid.

It was observed more than 30 years ago that the parathyroids were hypertrophied in rickets. More recently it was demonstrated that animals reared in an environment deficient in ultraviolet rays also showed hypertrophy of the parathyroids. It is common knowledge that rachitic children are more commonly afflicted with infantile tetany or spasmophilia than are children affected by other conditions. There is, then, some kind of relationship between parathyroid function and the action of vitamin D, even though the effects of the extract and the vitamin differ materially in many ways which clearly distinguish them. It must therefore be assumed that the two subserve different functions which overlap to some extent but are still distinct.

After the epochal development of methods of extracting the parathyroid hormone, the study of excess administration led quickly to recognition that certain clinical bone conditions are due to hyperparathyroidism. Subsequently it has been found possible to deal with these conditions by surgical removal of a part of an overfunctioning parathyroid gland, as in osteitis fibrosa and osteoporosis.

RELATION TO THE PITUITARY

It was observed many years ago that removal of the thyroid causes hypertrophy of the anterior pituitary and that similar changes occur in myxedema. There was also an increase in colloid so that it sometimes assumed an appearance similar to the thyroid. This was at first interpreted as a substitution of function whereby the pituitary replaced

the lost thyroid function. It was very soon shown, however, that this colloid material contains no iodine, as does that of the thyroid.

Within recent years it has been shown that extracts of the anterior pituitary produced thyroid hyperplasia with diminution of its iodine content. It was also shown that when anterior pituitary extracts were administered, liver glycogen in normal animals, but not in thyroidectomized animals, became rapidly depleted. When the pituitary is removed from young animals the thyroid ceases to develop and finally tends to atrophy.

Acromegaly, a disease associated with overactivity of the anterior lobe, is often accompanied by an enlarged thyroid. After anterior pituitectomy the metabolic rate is lowered and the blood calcium concentration falls, effects which are counteracted by the injection of extracts.

While pituitectomy lowers the metabolic rate, subsequent thyroidectomy lowers it still more. But if the order of operation is reversed the second operation causes no further lowering of the metabolic rate.

These and other observations have established that the anterior pituitary, among its other functions, produces a thyrotropic substance that controls or activates the thyroid. That this is a direct effect is shown by the fact that thyroid transplants are as readily affected as the normal thyroids.

After pituitectomy, parathyroids show atrophy or degeneration. Conversely, injection of anterior-pituitary extracts causes hypertrophy and hyperplasia of the parathyroids and increases blood calcium. When the parathyroids are removed first this increase in blood calcium does not occur. Hyperpituitary conditions are frequently associated with parathyroid hyperplasia and symptoms of osteitis fibrosa.

Pituitary deficiency in animals increases the total calcium and phosphorus content in the whole body while extracts cause a diminution.

These observations clearly indicate that the parathyroid, like the thyroid, is under the control of the anterior pituitary which seems to be the master control over all endocrine functions. Furthermore, it is clear that the endocrine system is even more complicated than formerly believed and that either directly or through the anterior pituitary, all of the major members of the system are related.

It is also clear that the metabolism of calcium and phosphorus is intimately related to the function of the parathyroid, less intimately with the thyroid, and that the anterior pituitary controls both the thyroid and parathyroid. However, there may be a direct control also, since pituitary disturbances, especially acromegaly, are related to calcium-phosphorus metabolism, but the full picture is not yet clearly set forth.

Hypophysectomy delays dental solution and causes shorter roots and wide pulp chambers, and imperfect calcification. In the human, eruption is delayed and deciduous teeth persist; there is also imperfect calcification, although the incidence of caries is small.

RELATIONS OF THE PITUITARY AND THYROID TO VITAMIN D

It has been demonstrated that vitamin D in very large doses will increase the metabolic rate of normal dogs. The

parathyroid hormone will not produce this effect, therefore it is not due to parathyroid stimulation by the vitamin. Removal of the thyroid prevents the caloric response to excess vitamin D. Also removal of the anterior pituitary prevents this response to the vitamin. It appears, therefore, that the vitamin in excess amounts acts on the anterior pituitary, and indirectly via its thyrotropic hormone, on the thyroid. The parathyroid also seems to be involved since the blood calcium of an hypophysectomized dog is not increased in response to the vitamin.

FUNCTIONS OF CALCIUM AND PHOSPHORUS

1. The most obvious function of calcium is bone formation. Most of the total store is involved in this process. With the exception of dental enamel, bone is not fixed and constant but is ever undergoing decomposition and restoration so that the constituents must be replaced rapidly.

2. Calcium ions have a further function of decreasing membrane permeability, thus antagonizing the action of sodium and potassium ions. The latter increase permeability, thus increasing the tempo of life of the tissues, and so the rate of destructive metabolism in the cells is allowed to go to dangerous stages unless checked by calcium ions. This function also applies to capillaries.

3. Some evidence has been produced to the effect that calcium is in some way concerned with the transformation of chemical energy into muscular contraction, since it will greatly augment the force of contraction.

4. Calcium is also necessary in the transport of nerve impulses from one neuron to another, but the mechanism is not clear.

5. Calcium is also important in the blood clotting process.

6. There is indirect evidence that calcium has a definite effect in the maintenance of water balance, most probably by virtue of its osmotic action.

7. Calcium is necessary for the coordinated functioning of the heart.

8. Phosphorus plays a prominent rôle in the regulation of acid-base reactions, acting as a buffer in the fluids and tissues.

9. Phosphorus, in combination with carbohydrate, forms a hexose phosphate which takes part in the process of muscular contraction; this process of phosphorylation appears also to be involved in the absorption of fat and carbohydrates from the intestine and in the resorption of glucose in the renal tubules.

10. In the form of phosphocreatine, phosphorus enters into the process of propagation of nerve impulses and is believed to be the source of energy of contraction in muscle.

EDITORIAL

Beula Becker Marble—Sixteenth President of the American Dietetic Association

Many of those who have risen to prominence in American life today, point with pride to their birth or upbringing on one of America's farms. Their pride in this is justifiable, for the foundation of America was and is its farms. It was Washington, himself, who said, "Agriculture is the noblest profession in which men engage." And what better early experience could there be for a future dietitian than life on the farm, where no one may escape real knowledge of food, its production, preparation and consumption? Applied nutritional science had its awakening, in this country at least, in the feeding of farm animals. Many an alert farmer in bygone generations in reality practiced the principles of scientific nutrition as we know them today, in the feeding of his farm animals, even though he may have but dimly seen the import of these principles for himself.

But the little farm boy and girl were able to get their succulent carrots right out of the fertile soil, and to eat these and the rosy apple and the rich milk, direct from the source, free of contamination, and filled with the pristine glory of the vitamins. And so they grew up, strong, bright-eyed, and filled with ambition, and one of these little farm girls is now president of the American Dietetic Association.

Beula Becker Marble was born on a farm in Tremont, Illinois, in 1906, the year that Sir Frederick Gowland Hopkins made his famous prediction: "I can assert that later developments of the science of dietetics will deal with factors highly complex and at present unknown." Born under such a favorable aegis, of sturdy English and German forebears who came to this country in 1640 and 1840, the small infant forged ahead and literally grew up with the vitamins.

She took the public schools of Illinois in her stride, and hastened on to the University of Illinois to major in nutrition. She captured Phi Beta Kappa in her junior year and was initiated into Omicron Nu and Iota Sigma Pi. Her favorable destiny continued, for she was accepted as a nutrition intern (now generally termed "student dietitian") at the University Hospital of the University of Iowa, where she had the inspiring leadership of Dr. Kate Daum. Here she received the M.S. degree in 1928.

That fateful first job now awaited her, and the choice could have led her to the West Coast, the Middle West, or Beirut, Syria, but her kindly destiny again shaped her course and led her to the Research Ward of the Massachusetts General Hospital where her future husband was medical resident. Her marriage to Dr. Alexander Marble followed in September 1930, and later she spent a year and a half abroad with Dr. Marble on a Moseley traveling fellowship. There she had the opportunity to visit the great medical centers in Vienna and Berlin and Würzburg, Germany, with six months in London. Mrs. Marble spent much of her time in London working with Margery Abrahams at St. Bartholomew's. She also did some postgraduate work in educational psychology and advanced nutrition at the London School of Economics.

Returning to the states in 1932, Mrs. Marble began her present work as research ward dietitian under Dr. Joseph C. Aub at the Huntington Memorial Hospital of the Harvard Medical School.

Beula Marble has more than done her share in "working up from the ranks" in her professional circles. For her state association she has been program chairman, chairman of the Professional Education Committee, and president. She proposed the first refresher course for dietitians in this country, but as she says, "Gertrude Spitz and everybody else did all the work."

In the American Dietetic Association Beula Marble did distinguished work on the Membership Committee and as secretary. Later she served as chairman of the Diet Therapy Section, during which she initiated the presentation of original reports by members of this section. During her office as national vice-president, she continued to fit herself and demonstrate her ability to hold her present high office.

In the midst of her many professional and social duties, Mrs. Marble has succeeded in tucking in two compatible hobbies, singing and gardening, and in the pleasing setting of her home she presents a delightful picture, a little farm girl who grew up successfully to combine marriage with a professional career. Her gentle and competent leadership will be an incentive to the future progress of the American Dietetic Association. We welcome her as our sixteenth president, and may her happy destiny continue to carry her through the coming years.

Fortification of Foods with Minerals and Vitamins

That nutrients essential to human nutrition have been removed from the refined foods to which the public taste has become accustomed, is now an established nutritional fact. The question of restoring these essential elements becomes important, therefore, and decidedly so to the dietitian, whose particular concern is the practical problem of feeding people. Various aspects of the subject were discussed at a symposium on the fortification of foods presented before the Toronto meeting of the American Institute of Nutrition this year and published in the July 1939 issue of the Milbank Memorial Fund *Quarterly*.

Approaching the problem from the point of view of the advantages and disadvantages to be derived from the provision of increased amounts of vitamins and minerals in the common diet, Dr. Agnes Fay Morgan assumed that the possible advantages should be posed with the query whether or not the enrichments should restore the foods to their natural composition, or whether an excess of the chemically pure substance should be added to both processed and natural foods. Clearly, she believes, full restoration of the qualities of "wholeness" and "freshness" to our civilized fare is not an easy or simple task. But certain plain deficiencies are evident and universally acknowledged. Thus we have "chemically pure sucrose, decorticated and degerminated cereals", and other foods to which lost constituents may be restored, in whole or in part, by modifications of their industrial preparation. But the return of these essential factors cannot assure us of adequacy until the whole story has been unfolded.

Is it desirable to add an excess of vitamins beyond that ordinarily present in whole, fresh foods? In other words, should they be "spiked"? Dr. Morgan

believes that no positive answer is available at this time. She cites what P. György calls the "concurrence of the vitamins"; latent deficiencies of one vitamin may appear frankly evident when an excess of another vitamin is administered. Thus pellagrins treated with large doses of nicotinic acid develop new symptoms characteristic of vitamin B_1 and other deficiencies. Likewise, unbalanced and uncritically adjusted additions of certain minerals to foods may result in unexpected manifestations of deficiencies. The rickets-producing effect of cow's milk fed to human infants comes as a result of the excess of calcium over phosphorus as compared with the needs and digestive capacity of the infant, and often results in intestinal precipitation of calcium phosphate and low phosphorus rickets. Vitamin D milk may in one way or another restore normal conditions and thus is desirable for infants deprived of their rightful heritage, human milk.

Dr. Morgan believes that the decline in milk production by human mothers may itself be related to the increasing sophistication of the diet, lactation apparently being peculiarly dependent upon the intake of B vitamins and certain amino-acids. According to her, the case for the use of fortified foods by the pregnant woman seems less complete.

Some of the possibilities for harm from excesses of vitamins and minerals have already been pointed out. The margin between therapeutic and toxic doses of vitamin D is variable and influenced by unknown individual factors. Kidney damage may result from excessive calcium or phosphate ingestion with or without vitamin D. Some reports of damage due to excess carotene and vitamin A have appeared from European laboratories. Others have shown conclusively that enormous doses of these substances cause no damage. Caution should be observed, however, in the use of fish liver oils and concentrates until the facts are more definitely established. The possible relation of vitamin E to tumor production and the inherent toxicity of nicotinic acid amide, as well as the concurrence of the vitamin deficiencies which it may entail, are other deterents to indiscriminate food fortification.

Nevertheless, Dr. Morgan believes that the use of fortified foods and vitamin concentrates "can be justified probably in all restricted or reduced diets, especially those in use for long periods of time and in persons with gastro-intestinal derangements. These 'special purpose' foods are unquestionably needed in reducing diets, diets for nephritic and cardiac conditions, for alcoholics, for old age, for peptic ulcer, diabetes, in preparation for surgery, and for all deficiency conditions." A debatable case in point is the use of iodized salt, advocated in goitrous regions and of unquestioned value to iodine-deficient people, yet a possible danger to those with adenomatous thyroids.

With regard to ascorbic acid, Dr. Morgan's laboratory has shown convincing evidence recently "that both orange and tomato juices carry something which is indispensible in addition to ascorbic acid."

From the available evidence, Dr. Lydia S. Roberts concluded that the diets of our people at best have no great margin of safety, and that a significantly large proportion of them, especially in the lower income groups, are deficient in one or more of the dietary essentials. Outstanding among these deficiencies

are calcium and vitamin B_1 and the pellagra-preventive factor or factors. Iron, vitamins C and D, and other fractions of the B complex are also questionable and "in none of these constituents is there any generous margin of safety". Evidence of widespread calcium deficiencies is shown in the generalized osteoporosis common in adults, especially after fifty. Such active manifestations of demineralization can be explained by a prolonged negative calcium balance over a period of years, due to inadequate dietary calcium intake or insufficient vitamin D to favor its utilization.

With regard to B_1, the inclusion of a liberal amount of the protective foods will bring the diet up to minimum standards for this vitamin. It is difficult, if not impossible, however, to reach optimal vitamin B_1 standards and still include the quantities of white bread, sweets and other refined foods which people demand. One hundred years ago cereals supplied 32 per cent of the calories in the diet, and milling recovered 85 to 90 per cent of the grain as flour, containing 75 per cent of the original vitamin B_1. Today, cereals constitute but 24 to 25 per cent of the total calories; modern milling utilizes but 70 to 75 per cent of the grain and but 10 per cent of the vitamin B_1. The modern white bread, sweets and refined food diet is, therefore, poorer in vitamin B_1 by 500 to 550 units, in spite of the increased consumption of milk, fruits and vegetables. As a result, an impressive amount of evidence shows that "beriberi in characteristic form is endemic in many parts of the United States, but that its presence is concealed by its diagnosis under many different names." Certain of the various forms of polyneuritis, some believe, are all true beriberi caused by a relative lack of B_1 in the diet.

It is readily apparent, then, that the American diet needs improving. An ideal solution would be increased consumption of the protective foods and a lowered consumption of sophisticated and refined foods. Only a long and vigorous program of popular education could accomplish this, Dr. Roberts believes, and we are faced with the urgent need to better the nutritional status of our people. The line of least resistance might be to add to certain basic foods, consumed in largest amounts by the masses, the dietary essentials most lacking, so that willy-nilly the deficiencies would automatically be met. The chief danger, however, as Dr. Roberts sees it, is that such a fortification procedure might tend to give a false sense of confidence that all the deficiencies of refined cereals, for example, had been overcome. Yet more than thiamin or any other single vitamin is lost in the milling process, and some of these other factors may be equally important in human nutrition. If fortification is accepted, then the safest procedure is the fortification of natural carriers: iodine to salt, the various B factors to cereals, and the addition of vitamin A to all butter substitutes.

Dr. W. H. Sebrell, on the other hand, maintained that "the fortification of foods with vitamins and minerals, then, in all probability would . . . fail to be of any material value in the prevention of deficiency diseases by not reaching the population group in greatest need of them." He believes that the deficiency disease problem will never be solved by fortifying foods, but can be solved by making available to all classes the widest

variety of natural, unrefined foods at the lowest possible prices. Unfortunately "there seems to be some quirk in most of us that makes us want to take a pill". Swallowing it, we are inclined to look forward contentedly to a miraculous and completely curative result. Instead of continuing to associate curative results with unpleasant medicine, we should attempt to build up an association between good health and a "colorful diet", bright with the red, yellow, orange and green colors of natural foods which are not likely to be deficient in minerals and vitamins.

Dr. Alonzo E. Taylor, in the final address of the symposium, stated that we must first seek *retention* of native vitamins, then *restoration* when advantageous, then *fortification* when warranted, leaving medication to the last, and applicable only to regions and groups where ingestion of vitamins as food components encounters exceptional difficulties. An ultramodern point of view might regard foodstuffs merely as carriers of protein, fat and carbohydrate, and endeavor to supply the accessories, including minerals and vitamins, more or less synthetically in tablets. We must separate *prevention* from *treatment*. Clear-cut clinical deficiencies respond best to concentrates in capsule or tablet. But prevention of deficiency through adequate intake of vitamins should be sought in the food supply, in which vitamins have been retained or restored, or to which appropriate fortifications have been added.

The Journal of Nutrition Changes Editors

In 1929 when this Journal was but a four-year-old, it extended an editorial welcome to another fledgling in a closely allied field, the *Journal of Nutrition*. Since then, under the continuing and able editorship of Dr. John R. Murlin of the University of Rochester, the *Journal of Nutrition* has become firmly established in the world of nutritional science and has served to entrench this science as an effective ally of the medical arts.

Dr. Murlin, having weathered the difficult early years and having seen his venture reach its present happy degree of success, now finds it necessary to relinquish his duties as managing editor. This Journal, therefore, speaking for the members of the American Dietetic Association, takes the opportunity to express appreciation of Dr. Murlin's untiring service and balanced judgment. His editorial discernment has been a potent factor in placing nutrition so securely in the scientific world. His own contributions in the field of nutrition research are extensive and fundamental. At all times he has been a keen and constructive critic of the work of others, and thus has saved the young and rapidly growing science of nutrition from its overly enthusiastic supporters, eager to report insignificant and premature findings. A sound and mature judgment and ability to refuse, firmly and impartially, all papers not up to his high standards, have enabled Dr. Murlin to bring his ten years' service to the *Journal of Nutrition* to a successful close.

The newly appointed managing editor, Dr. George R. Cowgill of Yale University, is well qualified by education and experience to meet the responsibilities of his office. There is every indication that the future will see a continued adherence to high standards and professional integrity within the covers of the *Journal of Nutrition*.

CURRENT COMMENT

The Low Fat, High Carbohydrate Diet in Diabetes[1]

An experiment on the low fat, high carbohydrate diet was done on a 66-year-old diabetic male with hypertensive cardio-vascular disease and bilateral mid-thigh amputation of both legs. His diabetes was diagnosed in 1933, at which time he came into the hospital with a blood sugar of over 400 mg. per cent and a gangrenous toe. A mid-thigh amputation was then done. The following year an infected heel necessitated a second mid-thigh amputation.

At the time the experiment was started in 1938, his normal diet figures were protein 70, fat 140, carbohydrate 200, and he required from 5 to 20 units of regular insulin on this diet. His diet was made isocaloric with carbohydrate, the figures being protein 70, fat 24, carbohydrate 385. Fat was given in the form of 600 gm. of milk per day. The diet was continued for one month and on this the total cholesterol dropped from 200 + to 146 −. Esterified cholesterol remained practically the same and the insulin was stopped entirely. Fasting blood sugar at this time varied from 93 to 109 mg. per cent.

After this the patient was returned to his normal diet figures of protein 70, fat 140, carbohydrate 200, and within one week his fasting blood sugar increased, so that insulin was again required and he is now getting from 10 to 15 units of regular insulin per day.

The low fat, high carbohydrate diet given this patient consisted largely of cereal, fruit, vegetables, bread and cottage cheese. It was also necessary to give jelly to make up all of the carbohydrate and to insure a more palatable diet.

The patient was given ferrous sulphate at this time also, because the number of blood specimens that were taken, together with the fact that little iron was supplied by the diet, reduced the hemoglobin concentration.

Since most of the diabetic diets today are still rather high in fat, this experiment may prove interesting because it suggests that fat increases the requirement of insulin. However, further studies will be necessary.

This experiment was done by Dr. John G. Reinhold, chief of the Division of Biochemistry at Philadelphia General Hospital, through the courtesy of Dr. Joseph R. Schaefer, assistant chief resident physician of the Metabolic Department of the same hospital. Complete results will be published elsewhere.—Vera E. Kerstell, *Staff Dietitian, Philadelphia General Hospital.*

[1] Read before the Philadelphia Dietetic Association, Philadelphia, February 28, 1939.

A Camp for Diabetic Children[1]

Diabetic children are not admitted to the average camp for children. The reason, of course, is that the diabetic child's diet has to be weighed or measured and the child must have prompt treatment should he become ill or develop hypoglycemic shock. The Philadelphia General Hospital Society has supported a camp for such children, in which boys and girls were received at separate periods, but not divided into age groups. Each group remained in

[1] Read before the Diet Therapy Section, Pennsylvania Dietetic Association, Hershey, Pa., May 13, 1939.

the camp three weeks. The boys had excellent appetites and with the increased exercise found it difficult to observe their diets. The girls likewise had good appetites, even though their exercise was not so vigorous.

The diets were simplified as much as possible. All received the same amount of milk, vegetables and fruit; bread, butter and meat being the variables. At all meals except breakfast, low-calorie foods or "fillers" such as broth, lettuce, celery, asparagus, spinach, cucumbers or radishes were given. Each received 200 gm. milk at each meal. Eight of the group received goat's milk and the remainder, cow's milk. Goat's milk was used in an effort to determine if there was any superior and appreciable gain in weight from its use. No one objected to the goat's milk until camp was almost over when they were told what they had been drinking. Several of the children thereupon refused the milk.

Extra carbohydrate was given to both girls and boys before retiring and helped considerably in reducing the number of shocks during the night. The boys were given a glass of milk or 10 gm. carbohydrate, while the girls received a glass of milk and one-half a sandwich with a meat or meat-substitute filling, approximately 20 gm. carbohydrate.

Our food supply came from two entirely different sources. The staples were sent from the hospital, while our fresh fruits, vegetables and meats were ordered daily from a nearby market. Fresh foods were used whenever possible. Supplies came from the hospital only once a week, so large amounts had to be stored, including butter, eggs, milk and other foods, and supplies of insulin and glucose. In such camps if not elsewhere, perhaps, ice boxes and pantries should have locks but ours did not.

Each morning three or four children went on what they called "kitchen police" duty for two hours. The older ones set the tables or prepared a fresh vegetable. These children also reported to the dietitian before each meal and carried the plates from the kitchen into the dining room. The food was always weighed under the direct supervision of the dietitian, or by the dietitian herself, if there were no older children in the group. The children also washed the dishes and cleaned up the dining room. The sink for dishwashing was conveniently located on a porch outside the kitchen, which made it possible to enforce the rule that children could not come into the kitchen unless they were assigned there. When one sees something to eat, there is always the temptation to nibble or taste, and diabetics, especially children, are inclined to be susceptible to food sampling.

The camp as a whole was quite successful. The children had an excellent time and improved in health. Undoubtedly, in such camps, the cook should be carefully chosen and under the direct supervision of the dietitian.—JANE GORDON, *Student Dietitian, Philadelphia General Hospital.*

BOOK REVIEWS

Vitamins and Vitamin Deficiencies. By Leslie J. Harris. Philadelphia: P. Blakiston's Son & Co., Inc., 1939, pp. 190. Price $2.50.

The mere fact that this, the first of a series of seven volumes on the vitamins, carries a commendatory foreword by Professor F. Gowland Hopkins, is sufficient to assure its acceptance by the student, teacher and practitioner. The contents comprise a well-digested, well-knit story of the vitamins that can be read with enjoyment and used to advantage.

As the author states in his preface, the book is a comprehensive but not exhaustive synopsis of the subject. One of the minor yet nonetheless interesting features is the careful attention to historical details concerning the pioneers in the investigation of vitamins. Photographs of these early pioneers—Lind, Takaki, Holst, Hopkins, Eijkman, Grijns, Funk and our own McCollum—are assembled on two facing pages with brief statements appended concerning the contribution of each that has been the passport to this select grouping.

The whole of our knowledge of the B_1 vitamin up to the middle of 1938 has been summarized within a reasonable compass and in a form particularly suited to the needs of the vitamin specialist. Dr. Harris has given particular attention to the incidence of the avitaminoses in various regions, "conditioned deficiencies", hypovitaminosis and its detection, alternative methods of estimating the vitamins and their relative merits, the mode of action of the vitamin, and an enumeration of the more newly recognized factors.

The typographical format, which shows a discriminating use of bold-face and italicized type, is decidedly helpful for rapid reference. Illustrations, graphs and tables are plentifully used and materially assist in clarifying moot points.

The B_2 complex becomes "less complex" under Dr. Harris' skilful treatment. Other less well-defined factors, described or postulated by various workers, and whose existence in most instances has been deduced on one experimental species only, are neatly lined up and concisely dispatched in the light of our present knowledge. An introductory outline preceding and brief summaries at the end of each chapter are further helpful aids to the harried student of the vitamins. Highly selective references to the literature and an author and subject index make this book indispensible for its purpose and therefore required reading for the dietitian and the nutritionist.

Food and Health. An Introduction to the Science of Nutrition. By A. Barbara Callow. Second edition. New York and London: Oxford University Press, 1939, pp. 161. Price 5s.

The author, M. Sc. (London) and M. S. (Yale), has recounted the story of nutrition, pleasingly interspersed with anecdotes and generously acknowledging American contributions. Originally published in 1928, the present edition has been enlarged and almost entirely rewritten. The food tables combine figures for vitamin content in International units with those for chemical content and fuel value. Like most books written for the student as well as the general reader, the contents hardly meet this dual purpose. Much would be unsuited for the student of nutrition; and conversely, much might be omitted that would be assimilated with difficulty by the "general reader". Certainly the dogmatic conclusion reached on page 56 concerning the use of soda in cooking green vegetables, a conclusion based on the unpublished work of a single investigator, has no place in a book written for the uninitiated.

Food, Health, Vitamins. By R. H. A. Plimmer, D. Sc., (Lond.) Professor of Chemistry, St. Thomas's Hospital Medical School, University of London, and Violet G. Plimmer. Eighth edition. New York: Longmans, Green and Company, 1939, pp. 219. Price $1.60.

The seventh edition of this little book was reviewed in this JOURNAL for March 1936. In the present edition, the author's practice of weeding out the outmoded and including the firmly established has been continued. Included in the book under review are the vitamin content of the chief foodstuffs, measured in International units, and much detailed, timely and authentic information on the vitamins. Also included are unique and forceful diagrams

which should prove useful to the teacher and illuminating to the student.

The Canned Food Reference Manual. Distributed by the American Can Company, 230 Park Avenue, New York City. Haddon Craftsmen, Inc., 1939, pp. 235.

Since 1935 the American Can Company has been issuing factual releases covering phases of canned food knowledge in the form of advertising copy appearing in professional publications. In answer to the demand for the assembling of this material under one cover, the present book was prepared.

The contents of this book as related to nutrition and public health have been reviewed and accepted by the Council on Foods of the American Medical Association. The sections cover Canning Technology; Canned Foods in Human Nutrition, containing chapters of interest concerning vitamin stability during canning, canned foods in infant and early child feeding, and food fads and fancies; Public Health Aspects of Canned Foods; The Past Twenty Years of Canning Research; Useful Facts About Commercially Canned Foods, including chapters on regulations covering processed or packaged foods, federal inspection and grading services relating to canned foods, and specifications and grades for canned foods; and the Federal Food, Drug, and Cosmetic Act.

The material included under the appendix is unusually extensive and pertinent. Included in the 75 pages of appendix are the following tables: Proximate Composition of Some Commercially Canned Foods; Proximate Composition of Some Unseasoned and Unsweetened Canned Foods; Reported Vitamin Values of Some Commercial Canned Foods; and the pH Ranges of Some Canned Foods.

Careers: Hospital Dietetics as a Career. By The Institute for Research (Devoted to Vocational Research), 537 South Dearborn St., Chicago: 1939, pp. 24. Price 75 cents.

Dietetics is defined herein as "the profession in which the science of nutrition is applied to the feeding of individuals. It is the study of the function of food in the body and the application of such knowledge to the attainment of maximum health and physical efficiency and to the prevention and cure of disease in human beings."

A brief history of the development of the science of nutrition follows with specific emphasis on the history of hospital dietetics, reminding the reader that "less than forty years ago the word 'dietitian' was unheard of" and that "Pioneers in dietetics were not very well versed in scientific knowledge, but what they lacked in learning they made up in skill in cooking." The work began in tiny kitchens under considerable difficulty but due to the perseverance of these pioneers and their successors, today the dietitian, in most hospitals, is in charge of an adequate and well organized dietary service. Furthermore, "she is regarded as an important and responsible executive head of a most essential department," one who is responsible for one-fourth to one-third of the hospital's expenditures.

The three types of work are described: administration, diet therapy and education, with considerable emphasis on the educational activities —the teaching of medical interns, medical students, student dietitians, student nurses and outpatients. Indeed the educational work in the food clinic and the social service department is said to be "one of the most interesting fields a dietitian may select." The dietitian as a teacher of student nurses is also stressed. The requirements of the National League of Nursing Education are outlined, and the reader is warned that dietitians who are to teach such courses should take special courses in education, in addition to being well trained in dietetics.

The minimum educational requirements for hospital dietitians are given and conform to those of the American Dietetic Association. Additional college subjects are suggested for those specializing in any one of the three types of work, such as additional training in the biological sciences and some medical courses for the therapeutic dietitian, while the administrative dietitian should have had more than the required training in the biological and social sciences and in institution management.

Salary ranges for the different types of positions are given. A minimum of $60.00 (with maintenance) seems low even for a beginner, but probably does hold true in some parts of the country. This is, of course, lower than the scale recommended by the Placement Bureau of the American Dietetic Association. Suggestions are given on personal qualifications, on the attractive and unattractive sides of the work and on "how to get started".

The monograph is well written, carefully and accurately prepared and should be made available to high school and college students who are seeking vocational guidance. It seems to fill the need long felt by home economics teachers as well as by vocational directors.—LENNA F. COOPER, *Chief, Department of Nutrition, Montefiore Hospital, New York City.*

Streamlined Cooking. By Irma S. Rombauer. New York: The Bobbs-Merrill Company, 1939, pp. 195. Price $1.75.

There should be a demand for this collection of recipes and other information. Arranged in streamlined form, the recipes are especially easy to follow and designed in general for the use of canned and other ready-to-cook foods. Included are a number of streamlined menus for breakfasts, luncheons, dinners, suppers and late snacks.

The author introduces each of the several sections devoted to appetizers, soups, meats, salads, etc. with general information concerning each group of foods. Thus, under the heading, meats, she lists a number of canned or packaged main dishes containing meats, and the frosted meats and poultry now available.

In spite of some disagreement with the author's rather sweeping assertions concerning the superiority of the canned version of soup *as soup* or as a basis for sauces and what not, it must be agreed that ready-to-use foods including soups and streamlined cooking are essential to present-day living, and the book under review meets a real need. By the way, it's H. H. Munro, not "Monroe" and the name is Helen Hokinson, not "Hockinson".

Nutrition and the Public Health. British Medical Association. London, B.M.A. House, Tavistock Square, W.C.1, 1939, pp. 150. Price 2s.6d.

This covers the proceedings of a National Conference on the Wider Aspects of Nutrition, April 27–29, 1939, in which the medical, agricultural, industrial and educational aspects of the whole problem were discussed. Of particular interest to dietitians are the addresses of those participating in the discussion of the medical aspects of nutrition; namely, Professor E. P. Cathcart, Sir Robert McCarrison, and Dr. G. P. Crowden. The appendix includes Professor V. H. Mottram's Sir Charles Hastings Lecture for 1939, entitled "Nutrition and the Public Health".

Bulletin of the Health Organisation. League of Nations, Geneva. Volume VII, No. 4. New York: Columbia University Press, 1939, pp. 610–681. Price 65 cents.

This includes the report of the Commission on Physical Education, a report of the work of the Health Organisation, and a report of the Technical Commission on Nutrition meeting in Geneva in August 1938. Among the problems discussed were the following: influence of climate on food requirements; and the extent to which diets in common use fall below the standards recommended in the report on the physiological bases of nutrition. "In general", it is stated, "it should be the aim of nutrition policy to rely on natural foodstuffs and, as far as possible, on locally produced foodstuffs, for the improvement of diet. Circumstances may, however, arise in which certain groups may benefit from the distribution of vitamins in pure and concentrated form, provided these can be obtained cheaply in large quantities."

Continuing, "Yeast is rich in nitrogenous elements and in the B group of vitamins; it is of particular value in correcting deficiencies in the diets of tropical and Eastern peoples, which are usually composed of cereals. Methods by which yeast rich in water-soluble vitamins can be produced cheaply on a large scale in such countries should be investigated."

Regarding minerals, the report states, "mineral deficiencies can often be made good by natural foodstuffs. Nevertheless, the expedient of supplementing diets by mineral elements as such should be borne in mind. Calcium salts, iron, iodine, etc., can be supplied cheaply to school-children and other groups suffering from a deficiency of these elements. Such a measure may be financially feasible when expense forbids the supplying of milk or other valuable foods."

Annual Report, 1937–1938, Henry Lester Institute of Medical Research (Shanghai, China). Director, Dr. H. G. Earle, Hongkong, China, 1939, pp. 90. Reprints of publications mentioned in this report are generally available to research workers and others on application to heads of division or to the director.

This is a report of the Division of Clinical

Research and Experimental Surgery, the Division of Physiological Sciences, and the Division of Pathological Sciences.

The work of the Division of Physiological Sciences, as reported, covers analyses of Chinese foods, the biological and chemical assays of vitamins, and numerous studies in nutrition. Much of this has appeared in the *Chinese Medical Jonrnal.*

Shrinkage and Cooking Time of Rib Roasts of Beef of Different Grades as Influenced by Style of Cutting and Method of Roasting. By Lucy M. Alexander, Associate Home Economics Specialist, Foods and Nutrition Division, Bureau of Home Economics, and Nancy Griswold Clark, formerly Junior Home Economics Specialist, Animal Husbandry Division, Bureau of Animal Industry. Technical Bulletin No. 676, United States Department of Agriculture, Washington, D. C., 1939, pp. 35. For sale by the Superintendent of Documents, Washington, D. C. Price 10 cents.

This presents the results of a series of experiments on 595 rib roasts in which eight different methods were followed. The studies concerned the influence of the style of cutting and the temperature of cut when put into oven on the shrinkage (loss of weight) and cooking time. Results appear to indicate that boning and rolling a roast reduce shrinkage. Cooking temperature had the greatest influence on shrinkage and cooking time. Searing in itself does not reduce shrinkage as was formerly believed.

CURRENT LITERATURE

American Journal of Digestive Diseases

Vol. 6, July 1939

*Our present knowledge of the action and sources of copper in nutritional anemia. C. P. Segard.—p. 315.

*Studies in human biliary physiology. III. The effect of bile and vitamin K on experimentally produced hemorrhagic diathesis in a human with a total external biliary fistula. I. C. Zuckerman, B. Kogut, M. Jacobi and J. Y. Cohen.—p. 332.

COPPER IN NUTRITIONAL ANEMIA. Copper is a necessity and a specific catalytic agent in hemoglobin formation. It is present in some foods but in wider variation than iron. In nutritional anemia copper is indispensable. Copper and iron medication is best given with food.

VITAMIN K. A hemorrhagic tendency was produced in 2 weeks in a young female with a total external biliary fistula by the feeding of a low-fat, vitamin K-deficient diet and the omission of oral bile feeding. This bleeding was not alleviated by the oral administration of bile or of vitamin K concentrate alone. The use of vitamin K concentrate in conjunction with orally fed bile produced a cessation of bleeding in five days.

American Journal of Diseases of Children

Vol. 58, July 1939

*Sulfur metabolism of early infancy. V. Iob and W. W. Swanson.—p. 37.

*A new carbohydrate for prevention of nutritional anemia in infants. Preliminary report. C. L. Wilbar.—p. 45.

SULFUR METABOLISM OF INFANCY. Skeletal growth, involving the conversion of cartilage into bone with a fourfold loss of sulfur, which is excreted by the kidneys, is suggested as an explanation of the reduced sulfur balances of growing infants.

PREVENTION OF NUTRITIONAL ANEMIA. Nutritional anemia among infants and young children is a definite entity and is found among the children of the sugar plantations of Hawaii. A new form of carbohydrate made from sugar-cane is described. It contains sufficient available iron and copper to prevent nutritional anemia in young infants.

American Journal of Public Health

Vol. 29, July 1939

*The selenium problem and its relationship to public health. I. A. Manville.—p. 709.

*Vitamin D potency of human breast milk. R. S. Harris and J. W. M. Bunker.—p. 744.

*Mean annual hours of sunshine and the incidence of dental caries. B. R. East.—p. 777.

*Restoring lost vitamins to the diet. Editorial.—p. 792.

Prolonged preservation of food. Editorial.—p. 793.

SELENIUM. Selenium is widespread in the earth's crust. It has been found in the soil, in the crops, in the water of temporary springs and in the drainage from irrigated lands. Acute effects of the ingestion of soluble selenium compounds consist primarily of early cellular destruction of the liver with later pathological changes throughout the organism. The ingestion of small amounts of selenium compounds over a long period results in retrograde changes in the liver and kidneys accompanied by a general debility. Extensive studies on the selenium problem are necessary.

VITAMIN D IN BREAST MILK: A composite sample of 15 gal. of human milk contained only 4 U.S.P. XI units of vitamin D per quart. The antirachitic superiority of human milk over cow's milk in infant feeding cannot be attributed solely to the vitamin D. The antirachitic potency of human milk is increased 5-fold by feeding metabolized milk to the lactating mother.

DENTAL CARIES. The mean caries incidence of 94,337 white boys, 12 to 14 years of age, residing in rural and semi-rural areas of 24 states during 1934–1935, was 353.50 per 100 boys. The mean caries incidence varied inversely with the hours of sunshine prevailing at their places of residence. Data suggest an inverse relationship between the caries-attack rate and the mean annual number of hours of sunshine recorded for the places of residence.

RESTORING LOST VITAMINS TO THE DIET. Despite the abundance and variety of American foodstuffs, the people of this country are not so well nourished as they should be. Recent investigations of approximately 4000 food records

among families in 43 cities have shown that half of these diets needed improvement. The most significant fault was a lack of sufficient calcium and vitamin A. Many of the diets were also inadequately provided with vitamin B_1 (thiamin), vitamin C (ascorbic acid), and iron. If manufacturers and processors of various staple foods would develop methods to retain or restore the natural vitamins and minerals that are sometimes removed from these foods, their popularity and abundance in the diet would assure a greater intake of essential food factors. Optimum nutrition is one of the most important factors in good health.

Annals of Internal Medicine

Vol. 13, July 1939

*Vitamin A content of the human liver in tuberculosis. P. D. Crimm and D. M. Short.—p. 61.

*Obesity and hypertension. J. E. Wood and J. R. Cash.—p. 81.

*The influence of iron and diet on the blood in pregnancy. F. H. Bethell, S. H. Gardiner and F. MacKinnon.—p. 91.

Vitamin A Content of Human Liver. The average vitamin A content of human livers in 50 cases of tuberculosis was 342 U.S.P. units per gram. The minimum was 3 and the maximum 1640. The vitamin A content of the human liver approached depletion in 14% of the patients, indicating that generous doses of vitamin A are indicated in tuberculosis.

Obesity and Hypertension. The literature indicates a definite association between obesity and systolic blood pressure elevation. Systolic blood pressure in normal and hypertensive dogs rises with weight gain and falls with weight loss, while systolic pressure varies very little. These observations do not indicate that obesity is a cause of essential hypertension but support the idea that overweight may be an important factor in the elevation of systolic blood pressure.

Iron and Diet in Pregnancy. The incidence of true anemia of pregnancy is high. Such anemia results from deficiency or impaired utilization of iron or from an inadequacy of animal protein in the diet. Inorganic ferrous preparations are the most effective and least irritating forms of medicinal iron in the treatment of hypochromic anemia of pregnancy. A diet supplying 50 gm. of animal protein daily, in addition to adequate amounts of other "protective" foods, is effective in correcting anemia of moderate degree attributed to dietary deficiency.

Archives of Internal Medicine

Vol. 64, July 1939

*Protamine zinc insulin: A metabolic study. E. Tolstoi and F. C. Weber.—p. 91.

Protamine Zinc Insulin. When protamine zinc insulin is used to treat diabetes, the glycosuria is not materially influenced by dietary shifts from equal to unequal portions. With protamine zinc insulin, the glycosuria was diminished by a lower carbohydrate diet, but the utilization of dextrose was greater with the higher carbohydrate diets. For patients treated with protamine zinc insulin the guiding feature of satisfactory treatment should be the maintenance of weight, freedom from symptoms and absence of ketone bodies in the urine. Glycosuria is desirable, as it affords protection from reactions.

Archives of Pediatrics

Vol. LVI, July 1939

*Rachitic studies: III. An evaluation of methods of antirachitic treatment. E. W. May and T. M. Wygant.—p. 426.

Some practical points in the feeding of healthy infants. M. Witkin.—p. 452.

Rachitic Studies. Irradiated cholesterol prevented rickets from developing in premature, weakling and normal full term infants and produced excellent linear growth in daily doses of from 200 to 500 U.S.P. units. It produced complete healing of severe rickets in premature infants in from 10 to 12 weeks by the use of 1000 U.S.P. units daily given in divided doses. The prophylactic effect of the vitamin D as it is dispersed in irradiated evaporated milk was almost equally as good in a lower daily dosage. Cod liver oil concentrate evaporated milks and cod liver oil, whose vitamin D dosages ranged from 200 to 500 U.S.P. units daily, appeared to be less effective than the irradiated evaporated milk in the production of good linear growth. Viosterol in oil and "drisdol" were equally efficacious in the prevention of rickets and in causing good linear growth when the daily intake was 400 to 800 U.S.P. units. Antirachitics containing vitamin A had no advantage over

the antirachitics which were not coupled with vitamin A, either in respect to infections, gain in weight or linear growth. No difference in the incidence of rickets in the male and female groups or in the black and white races was found.

British Medical Journal

May 6, 1939

*Relation of vitamin D and mineral deficiencies to dental caries. G. F. Taylor and C. D. M. Day.—p. 919.

DIETARY DEFICIENCIES AND DENTAL CARIES. Almost perfect teeth and little gross hypoplasia were found in a group of children with severe clinical rickets, radiologically confirmed. The diet was definitely deficient in minerals and vitamin D. Diets deficient in calcium, phosphorus and the fat soluble vitamins, and rich in "anti-calcifying" cereals, did not lead to a greater susceptibility to dental caries. The physical nature and cleansing action of the diet may be of greater importance than the other factors in the prevention of dental caries.

Canadian Medical Journal

Vol. 40, June 1939

*Proper feeding and good health. E. Mellanby.—p. 597.

Vol. 41, July 1939

Dietary requirements for health. J. B. Orr.—p. 78.

PROPER FEEDING. The normal drink of all infants and children ought to be milk. Right up to the end of adolescence the daily milk intake should be not less than a pint, and 2 pints would be much better. More eggs are eaten per head of population in Canada than in almost any other country. Complexity of dietary is not needed for the maintenance of good health. Some communities living on the simplest dietary are the healthiest in the world. Much bodily discomfort and ill health are due to overeating. People should consume greater quantities of protective foods during early life to assure the benefits of health that would follow.

Hygeia

Vol. 17, July 1939

*How safe is the roadside restaurant? J. E. Browell.—p. 590.
*Fruit juices.—p. 645.
*Vegetables for flavor. C. Adams.—p. 648.
*The school lunch in education. J. V. Latimer.—p. 666.
A lesson in dental health education. H. M. Fitzgerald.—p. 669.

ROADSIDE RESTAURANT. Too many travelers show a marked indifference to the unhealthful conditions found in some of the roadside eating places. The various state legislatures are slowly awakening to the need for proper sanitary control, and some have passed rigid hotel and restaurant regulations intended to include all eating places. The motorist will do well to look around a bit before he patronizes a roadside eating place.

FRUIT JUICES. Canned orange juice is a little more than twice as potent in vitamin C as canned tomato juice. Canned grapefruit juice has a vitamin C potency only slightly less than that of canned orange juice. Canned pineapple juice is about one-third as potent in vitamin C as canned orange juice. Twelve ounces of canned lemon juice contained about 2500 units of vitamin C; orange juice, 2250; grapefruit juice, 1875, and pineapple juice, 750, according to the determinations made in 1937 for the Council on Foods of the American Medical Association. The usual requirement of vitamin C in the adult is about 600 to 1000 I.U. daily. The brands of fruit juices which are accepted by the Council on Foods are listed.

VEGETABLES FOR FLAVOR. The minerals and vitamins in vegetables must not be conserved at the expense of flavor and color, according to this writer. To retain color and flavor, vegetables should cook uncovered to allow the volatile acids to escape in the steam. Spinach contains undesirable oxalic acid and should be cooked in large amounts of water and the water discarded. Nine recipes for vegetable dishes are given.

SCHOOL LUNCH. The school lunch is an essential part of the health teaching and health protective aspects of the high school's program for health. The Massachusetts Department of Public Health has long been interested in promoting better school lunches. Methods and results are included.

Journal of Biological Chemistry

Vol. 129, July 1939

*Anemia caused by feeding cholesterol to guinea-pigs. R. Okey and V. D. Greaves.—p. 111.
*Vitamin interrelationships. I. Influence of avitaminosis on ascorbic acid content of various tissues and endocrines. B. Sure, R. M. Theis and R. T. Harrelson.—p. 245.

ANEMIA DUE TO CHOLESTEROL. One per cent cholesterol fed to guinea-pigs on a synthetic diet adequate for normal controls, first produced enormous and fatty livers. After about 5 weeks of cholesterol feeding, the animals became seriously anemic. Red cell counts sometimes fell 2 to 3 millions within 2 or 3 weeks. Splenic enlargement took place rapidly, and within 7 to 8 weeks spleens were usually 10 times normal size.

VITAMIN INTERRELATIONSHIPS. Fasting for as long as 10 to 11 days produces no changes in the concentration of the ascorbic acid content of tissues or endocrines in the albino rat. The ingestion of 4 to 16 mg. of ascorbic acid per day in addition to a satisfactory diet does not result in an increase of the concentration of this vitamin in tissues or endocrines. In vitamin B_1 deficiency the most significant changes in ascorbic acid were found in the lung, kidney and liver. In vitamin A deficiency the only changes in ascorbic acid were found in the heart, kidney and thymus. The greatest reductions of ascorbic acid in single vitamin depletions occurred in the riboflavin deficient diets. In vitamin B_6 avitaminosis only, no noteworthy changes occurred in ascorbic content of either tissues or endocrines.

Journal of Nutrition

Vol. 18, July 1939

*Retarded growth, life span, ultimate body size and age changes in the albino rat after feeding diets restricted in calories. C. M. McCay, L. A. Maynard, G. Sperling and L. L. Barnes.—p. 1.

*Chemical and pathological changes in aging and after retarded growth. C. M. McCay, G. H. Ellis, L. L. Barnes, C. A. H. Smith and G. Sperling.—p. 15.

Bone development in normal and rachitic rats. W. C. Russell, M. W. Taylor and M. T. Duncan.—p. 27.

*The utilization of energy producing nutriment and protein as affected by the level of the intake of beef muscle protein. E. B. Forbes, A. Black, E. J. Thacker and R. W. Swift.—p. 47.

*Dynamic effect and net energy values of protein, carbohydrate and fat. E. B. Forbes, J. W. Bratzler, E. J. Thacker and L. F. Marcy.—p. 57.

*The vitamin D requirement of young turkeys. T. H. Jukes and T. D. Sanford.—p. 71.

*The anti-acrodynic properties of certain foods. H. A. Schneider, J. K. Ascham, B. R. Platz and H. Steenbock.—p. 99.

GROWTH CHANGES ON RESTRICTED CALORIC DIETS. Rats were retarded in growth for periods of 300, 500, 700 and 1000 days before being allowed to grow to maturity. Members of each group were alive when the last of the control groups had died at an age of 965 days. Retardation of growth by diet, complete except for calories, affords a means of producing very old animals. Animals that are retarded for 300 days can never become as large as those that mature normally. After 1000 days of retardation only part of the rats were able to resume growth when adequate energy was allowed in the diet. The maintenance of a constant body weight in this period of old age does not check the growth of the bones.

CHANGES AFTER RETARDED GROWTH. Retarded rats were used for studying the chemical and pathological changes that accompany aging. The calcium of the eyes was found to vary from 34 to 1078 mg.% on a dry basis. Most of this calcium is deposited after an age of 900 days. Even at a very advanced age a few of the animals had intact teeth. About a fourth of all the teeth examined were carious or missing. Females exhibited more damage to their teeth than males although the females never produced young. Calcification of the aorta had a much higher incidence among retarded animals than among normals. Indirect evidence indicates that retarded animals are less susceptible to lung disease, when a year old, than the normals.

UTILIZATION AND PROTEIN LEVEL. The influence of progressively greater protein content of equicaloric diets was studied by means of feeding, metabolism and body analysis experiments with two groups, 24 each, of albino rats as subjects with quadruplet food control, the main food protein being beef muscle. The metabolizability of the diets diminished at a nearly regular rate from the 10% to the 45% protein diet. The heat production diminished slightly from the 10% to the 45% protein diet at a rate less than the accompanying decrease in metabolizable energy at the lower plane of nutrition, but greater than the decrease in metabolizable energy at the higher plane of nutrition. The body gain diminished materially at the lower plane of intake and increased slightly at the higher plane of food intake from the 10% to the 45% protein diet. Beef muscle protein does not have a greater heat stimulating effect than casein for growing rats.

DYNAMIC EFFECTS AND NET ENERGY VALUES. The dynamic effects and net energy values of beef muscle protein, dextrin and lard were determined, separately and in combination, by feeding these superimposed upon an approximately complete basal diet. Even though a nutrient is fed alone, it is never utilized alone. The combination in which it is metabolized largely determines its dynamic and net energy values. The dynamic effect of beef muscle protein was the highest, that of dextrin was intermediate, and that of lard the lowest. The dynamic effect of a mixture of these was much lower than would be computed from the individual measurements.

VITAMIN D NEED OF YOUNG TURKEYS. Growth of young turkeys was markedly influenced by vitamin D. In one experiment the birds receiving an ample supply of the vitamin weighed 93% more than the birds on the basal diet at 4 weeks.

ANTI-ACRODYNIC FACTOR IN FOODS. Fifty-two materials have been assayed for their anti-acrodynic activity, using the rat as the experimental animal. Fruits and vegetables were found to be poor sources, fish and meat fair, seeds, legumes and cereals relatively rich and certain vegetable fats extremely potent sources of anti-acrodynic activity.

Journal of the American Dental Association

Vol. 26, July 1939

*Significance of early dental caries. E. E. Starr.—p. 1089.
The dietary phase of denture prosthesis. N. Simonds.—p. 1121.

SIGNIFICANCE OF EARLY DENTAL CARIES. The development of dental caries, although having certain peculiarities of a local nature, seems to be largely dependent on metabolic dysfunction or dietary discrepancy for its existence. It often signifies general abnormal conditions. Early dental caries, especially of the first molar, is very prevalent and brings about many adverse conditions.

Journal of the American Medical Association

Vol. 113, July 1, 1939

*Influence of thyroid therapy on mental growth of cretins. Editorial.—p. 62.

Vol. 113, July 15, 1939

*Convulsions in childhood: A review of one thousand cases. M. G. Peterman.—p. 194.
*Allowable claims for the vitamin and mineral content of canned fruits and vegetables intended for infant feeding.—p. 215.
*A nonspecific factor in resistance. Current comment.—p. 236.

Vol. 113, July 22, 1939

*Conferences on therapy: Vitamins; vitamin B_1 therapy.—p. 297.
*Orange juice and vitamin C.—p. 352.

Vol. 113, July 29, 1939

*The preoperative and postoperative administration of vitamin K. H. R. Butt, A. M. Snell and A. E. Osterberg.—p. 383.
Vitamin K. Editorial.—p. 417.

INFLUENCE OF THYROID THERAPY ON CRETINS. Available evidence indicates that, although the level of mentality of cretins can rarely be brought within the normal range by thyroid treatment, there is in many cases a favorable response which shows a rough correlation to the intensity of treatment.

CONVULSIONS. The ketogenic diet is the treatment of choice in idiopathic epilepsy. For *petit mal* there is no other effective treatment. Most of the reported failures of the ketogenic diet are due to two factors: first, an attempt to treat organic lesions of the brain; and, second, a lack of understanding of the diet which results in a non-ketogenic diet.

VITAMIN AND MINERAL CONTENT OF CANNED FOODS. Vitamins A and G are little affected by modern canning procedures. Very little of the natural mineral content of the food is lost in canning. Vitamins B_1 and C are more or less adversely affected by canning processes, the degree of destruction depending on the characteristics of the food itself, the time and temperature of processing, and probably other factors. The Council on Foods requires that advertising claims, at least for the vitamin B_1 and the vitamin C content of canned strained foods, should be based on assays of the individual product.

NONSPECIFIC FACTOR IN RESISTANCE. The relation of physical fitness to the ability to withstand infection has proved highly variable in practice, although the belief that the physical condition affects susceptibility to infection in

some instances has been amply substantiated. For the rabbit, fitness was approximated in terms of warming time, that is, the number of minutes required for the recovery of 3 degrees of body temperature following chilling to a point between 95 and 96°F. Various factors producing circulatory impairment, including shock, the administration of morphine, exposure to overheating, deprivation of food and fatigue, were studied in relation to their effect on warming time. Fitness as measured in this manner is a factor of resistance in the rabbit to the extent that it reflects adequacy of capacity for sustaining circulation. Observations suggest that at least one of the factors in the increased resistance to infection lies in the capacity to maintain improved circulation.

VITAMIN B_2 THERAPY. The effects of the deficiency of vitamin B_2 which are concerned with pernicious anemia, sprue and pellagra are discussed.

ORANGE JUICE AND VITAMIN C. Fresh orange juice loses little of its vitamin C on standing in the refrigerator, if the juice is kept in a covered container.

VITAMIN K AND JAUNDICE. Deficiency in prothrombin can be controlled by certain fat-soluble materials present in alfalfa. Although vitamin K must for the present be considered an empiric remedy, its biologic activity in man and animals can hardly be questioned. The control of a deficiency of prothrombin depends on several factors: (1) a normal diet containing the antihemorrhagic factors: (2) the presence of adequate amounts of bile salts in the intestine, (3) a normal intestinal absorptive surface and (4) a physiologically normal liver.

INSTITUTION MANAGEMENT

Buildings and Building Management

Vol. 39, July 1939

*Thirty-three operating tips. L. Kayton.—p. 32.
*Developments in electrical wiring systems. W. E. Malm.—p. 38.
*Historic air-conditioning. M. Ingels.—p. 40.
*Decorating air grilles. F. P. Waguespack.—p. 46.

OPERATING TIPS. A collection of operating ideas showing a continuing trend toward better maintenance and more efficient operating results through the use of new and improved materials and equipment. The use of glass blocks in construction, disinfection of telephones and public equipment, cleaning methods, protective devices, improvements in installation methods, cleaning Venetian blinds, new paints, neon lighting, decorating tips, and special finishes are discussed briefly.

ELECTRICAL WIRING SYSTEMS. Increasing demands of electrical energy loads necessitate rewiring schemes in many buildings. Cost has been considered prohibitive until recently. The electrical distribution system embraces 3 principle items: duct or conduit which is not easily changed; copper conductors; and panel boards, switches, and other protective devices. The focal point centers on the copper conductors. The use of "thin-wall" conductors and bare neutrals plus the adoption of other new developments in the electrical industry subjected to the approval of the National Electrical Code are desirable from the standpoint of increased electrical and physical efficiency and lower operating and maintenance costs.

HISTORIC AIR-CONDITIONING. The evolution of modern air-conditioning from the rudimentary heating and ventilating systems of a century ago is clearly traceable in the United States Capitol Building at Washington, where the present system of complete air-conditioning, installed within the past ten years, uses tunnels and flues which were constructed almost 100 years ago.

DECORATING AIR GRILLES. A stencil design applied to an air grille relieves the black hole appearance of the ordinary air grille in an otherwise attractively decorated room. By placing tin foil covered building board an inch back from transoms which are to be blanked out, light is reflected, and the transoms retain the same appearance.

Horwath and Horwath

Vol. 19, May 1939

*World's fair restaurants.—p. 1.
*Maintenance, improvements, and profits. L. Toth.—p. 3.
Food and beverage costs.—p. 7.

Vol. 19, June 1939

*Food and beverage control. R. Rudolph.—p. 3.
*Food department. Horwath and Horwath.—p. 6.

Vol. 19, July 1939

Sales, occupancy room rates.—p. 3.
Food and beverage costs.—p. 3.
*Ten years ago and now.—p. 5.
*Estimate losses of room linen.—p. 6.
*National restaurant association trend of restaurant sales.—p. 7.

WORLD'S FAIR RESTAURANTS. Entertaining article describing 4 of the World's Fair restaurants—The Rheingold Inn Restaurant in the Sun Valley "Winter Wonderland"; The Ballantine Three-Ring Inn; The Casino of Nations; and The Court of Flame—type of food served is given for each, seating capacity and outstanding features.

MAINTENANCE. Costs of moving managers' offices are not alterations, but should be charged to current expense. Alterations which will result in more profit either through increased income or reduced operating expenses should be charged to alterations. It is a common error to treat maintenance expense as an improvement just because amount is large. Carry each class of building equipment in separate account and charge it off during its expected life and adjust accounts according to physical inventory.

FOOD AND BEVERAGE CONTROL. Hindrances to profit can be controlled by cost-accounting, and a good system of daily records, trend of sales, comparison of wholesale market prices, menu price comparison, trends in menu composition, successful ideas in menu writing and sales promotion, trends in food and beverage cost, prudent ideas that others use to cut costs, and buying specifications and standard portions.

FOOD DEPARTMENT. National Restaurant Association chart of trend of restaurant sales clearly shows the kind of information that can be useful in getting the most out of food merchandising.

TEN YEARS AGO AND NOW. Two charts which contrast conditions in 1938 with those in 1928 give average percentages of 5 hotels of less than 500 rooms and a composite statement of income and expenses. Average room rates in 1938 were down 22%; occupancy was down; payrolls took 36% of total income against 29% in 1928; house profit ratios were less than half those in 1928.

ROOM LINEN LOSSES. A chart compiled from records and estimates of housekeeping departments of 26 hotels gives average monthly room linen losses exclusive of discards. Losses are heaviest in large, high-class transient hotels and the smaller pieces have the largest proportion of disappearance.

TREND OF RESTAURANT SALES. Tabulation of restaurant sales of member restaurants of the National Restaurant Association for May 1939 as compared to May 1938. The total sales of 209 restaurants show an increase of 4%; food sales increase 4% and beverage sales 7%. Service restaurants had the largest increase of 5%. The restaurant trend figures will be available only through the monthly bulletin of the National Restaurant Association.

Hospitals

Vol. 13, July 1939

*Administration of the dietary department. E. M. Eck.—p. 78.
Flaked coffee.—p. 81.
Tenderized beef.—p. 83.
*When the dietitian buys food for the institution. G. Bulman.—p. 90.

DIETARY DEPARTMENT. Dietary department management involves the whole food problem, the ordering or buying of food, and preparation and service to all patients and personnel. This article discusses food purchasing, space for the department, equipment and costs, labor and the complete cost of the department.

DIETITIAN BUYS FOOD FOR INSTITUTION. Grace Bulman states that "A dietitian must be a person who can cook, a scientist, an economist, a psychologist, a teacher, an executive, a hotel steward, and above all, a diplomat." How the dietitian uses these abilities in control of the food budget is outlined. The article covers the effect of inefficiency in food buying. The factors influencing food buying are evaluated.

Hospital Management

Vol. 47, June 1939

*How raw food costs are determined at Indiana University Medical Center. J. B. H. Martin.—p. 44.
Summer beverages.—p. 46.
*Does the water softener earn its board and keep? J. E. Ream.—p. 50.

RAW FOOD COSTS DETERMINED CENTER. A discussion of routine accounting procedures relating to the determination of raw food costs centered around two methods: historical costs and predetermined costs as described by the director of the Indiana University Medical Center.

EFFECTIVE WATER SOFTENER. A discussion of the use of water softeners, showing advantages and disadvantages, savings in laundry, linen replacement and resultant appearance of dishes and silverware.

Journal of Home Economics

Vol. 31, May 1939

*The home economist in the community health program. H. D. Chape.—p. 289.
A study of values carried over in home economics. N. Albright.—p. 296.
*Chocolate beverages for the school lunch. M. D. Paige and M. C. Kelly.—p. 305.
*The institutional management association. H. Reynard. —p. 314.
*Ascorbic acid content of tomatoes as affected by home canning and subsequent storage, and of tomato juice and fresh orange juice as affected by refrigeration. O. E. McElroy, H. E. Munsell, M. C. Stienbarger.— —p. 325.

Vol. 31, June 1939

Nutrition as a national problem. G. Hambidge.—p. 361.
*Democratic living in a college residence hall. E. C. Gibbs.—p. 365.
Marketing conditions and the consumer. D. E. Montgomery.—p. 369.
Home economics research in progress in the south. F. L. MacLeod.—p. 374.
*Specifications for blankets. D. A. Taylor.—p. 382.
*A budget for the woman worker. J. Studley.—p. 384.

HEALTH PROGRAM. The rôle of home economics and its contribution to the health of the community through the health program, health propaganda, personal teaching and school lunch.

CHOCOLATE BEVERAGE. Enlightening article dealing with the problem of chocolate milk in the school giving a chocolate milk quiz as a help in obtaining the best possible chocolate beverage.

INSTITUTIONAL MANAGEMENT ASSOCIATION. Describes an association formed in England to define the profession, set standard of training, recognized salary scale and hours and holidays.

ASCORBIC ACID. Tomatoes canned in glass jars and stored lost from 30–50% while commercially canned tomato juice showed no significant loss in ascorbic acid value. Juice prepared from commercially canned tomatoes and from fresh tomatoes and stored under same conditions showed losses after 2 days. Freshly extracted orange juice covered and stored in refrigerator gradually lost after second day. No loss during first 24 hours.

DEMOCRATIC LIVING. Successful plan in practice in Seth Low Hall, Columbia University, where for the past 15 years students save from $3 to $4 each week by doing their own marketing, cooking and caring for their own utensils in a community kitchen and dining room.

BLANKET SPECIFICATIONS. In setting up requirements to define the 6 classes, the frequency distribution of yarn count, breaking strength, weight per square yard, thickness, air permeability, heat transmission, and change in strength on abrasion were used as a basis for requirements proposed in a table given in the article.

BUDGET. A budget for the woman worker in Connecticut with $18 per week as the minimum, required the following distribution for adequate maintenance: 60%, food and shelter; 15%, clothing; and 25%, other living essentials. The article also includes standards for meals in restaurants and a skeleton clothing budget.

Modern Hospital

Vol. 53, July 1939

*Food clinic comes of age. F. Stern.—p. 86.
*Bananas on the menu. D. DeHart.—p. 90.

FOOD CLINIC. The growth and development of the Boston Dispensary food clinic and outline of the training of the student dietitian for such work are described.

BANANAS. The advantages of buying boxed hands of bananas for institution use are listed. Methods of keeping bananas in cold and hot

weather, uses of the banana as a food and the stages of ripeness needed for each use are listed.

Nation's Schools

Vol. 24, July 1939

*Legislation of early 1939. H. M. Chambers.—p. 25.
*Training lunchroom managers. W. S. Pendergast and L. A. Wiles.—p. 62.
*Two way features do double duty. M. deG. Bryan.—p. 66.

LEGISLATION. First of series of articles reporting and evaluating the year's legislation affecting schools. West Virginia has introduced statutes prohibiting the employment of children in hazardous occupations. South Dakota, Indiana and West Virginia have extended and revised the school census. North Dakota has revamped statute relating to consolidation of schools and transportation of pupils. Oregon, West Virginia, Tennessee and Utah have introduced new bus specifications. Conservation instruction is being started in the high schools of Arkansas.

LUNCHROOM MANAGERS. Detroit board of education places as managers in its junior and senior high school cafeterias only home economics graduates who have majored in institution management and who have successfully completed an apprentice training course provided by the school system and described in the article. Training is valuable in providing laboratory in which skill, speed and self confidence may be developed.

DOUBLE DUTY FEATURES. Floor plan for junior high school cafeteria in California showing how two way refrigerator and the location of shelves obviate need for partitions.

Personnel Journal

Vol. 18, May 1939

*Theory and practice of temperament testing. M. E. Hemsath.—p. 3.
*New ideas in eye testing. C. E. Ferree and G. Rand.—p. 13.
Labor board director's views. J. T. Nylander.—p. 21.
*Aid for job seekers. C. Pfanstiehl and E. A. McAlpin.—p. 36.

TEMPERAMENT TESTING. As an indicator of psychotic tendencies the Humm-Wadsworth Temperament Scale helps to weed out possible trouble makers from otherwise acceptable employees. Employees who are assumed to be normal are given a test of 318 questions to be answered "yes" or "no". Scores ranging from − 3 to + 3 for each factor are arranged in form of a profile graph. Inspection of graph which has various temperament factors of Normal, Hysteroid, Manic, Depressive, Paranoid, and Epileptoid, shows what factor is predominant. From these results and past experience the employer is able to determine whether the would-be employee will be suitable.

EYE TESTING. By using two boxes on each side of the eye testing chart which are of special construction and suitable location a glareless chart holder has been made and with this, along with a chart of double-broken circles which includes double the number of sizes found on most charts and which proves to be a good test for visual acuity and astigmatism, more accurate results and tests can be made of worker's eyesight and easy separation can be made between good eyesight and that requiring treatment. The eye testing charts may be obtained from Bausch and Lomb Optical Company, Rochester, New York.

AIDING JOB SEEKERS. Because of the increased output of semi-skilled office workers from schools resulting in 3 applicants for all jobs, the Chicago Y.W.C.A. has been giving vocational tests and counselling in connection with its free employment service. Special attention is given those who are hard to place. These tests reveal whether the girl or woman would be acceptable in her desired work and if so she is encouraged to pursue this type of work.

Restaurant Management

Vol. 44, June 1939

World's fair restaurants.—p. 17.
*Directory of world's fair restaurants.—p. 19.
*A series of studies on five star kitchens.—p. 20.
*How $4,000 grew to $1,500,000.—p. 24.
*Safest place to eat.—p. 30.
Dictionary of alcoholic beverages.—p. 31.
*Better tea and coffee service.—p. 32.

DIRECTORY WORLD'S FAIR RESTAURANTS. All restaurants at the Fair are listed alphabetically. Data includes location, operator, manager, kitchen equipment, architect, description, hours, seating, entertainment, specialties, beverages, and price range.

New 5 Minute CREAM OF WHEAT

Rich in Iron of HIGH AVAILABILITY

● Extensive clinical studies have demonstrated the remarkable availability of the rich supply of iron incorporated in New 5-Minute Cream of Wheat. When fed in average quantities daily, this excellent first solid food not only prevents nutritional anemia in infants, but also effectively aids in its correction if present.

● New 5-Minute Cream of Wheat, through adjustment of the cooking water to optimum pH by means of its added minerals, cooks to full digestibility, even for babies, in 5 minutes of boiling, a feature appreciated by every mother.

● Its reasonable price, but a fraction of a cent for a generous serving, places it within the reach of even the lowest earning group. Its high nutrient value and its palatable taste make it a valuable breakfast food for older children and adults as well, thus necessitating the preparing of only one cereal for the entire family.

"Cream of Wheat" Reg. U. S. Pat. Off.

MINERALS

Each ounce of 5-Minute Cream of Wheat provides 12 mg. iron in highly available form, 143 mg. calcium, and 168 mg. phosphorus, all readily utilized, and thus contributes measurably toward satisfying the daily requirements of these essential minerals.

VITAMIN B_1

Through the addition of wheat germ (stabilized to prevent rancidity) each ounce of the New 5-Minute Cream of Wheat contains 15.5 international units of vitamin B_1. It is thus an excellent source of this vitamin for infants.

THE CREAM OF WHEAT CORPORATION
MINNEAPOLIS, MINN., U. S. A.

Regular Cream of Wheat as always manufactured will continue to be available through the customary trade channels.

FIVE STAR KITCHENS. Buttonwood Manor heads the list of five star kitchens. Outstanding features include adequate ventilation, sterilized dishwashing, good lighting, stainless surfaces, modern equipment and a beautiful view of the woodlands. Guests are invited to see the kitchen. Cleanliness, new equipment, fresh food, stainless surfaces, and off-the-floor equipment are additional attractions. Floor plans and equipment lists accompany the article.

FROM $4,000 TO $1,500,000. Kenneth Eaton Bemis has developed several quick lunch chains throughout the country. These restaurants are operated cleverly, making use of many ingenious devices for securing uniform production, consistency of flavor and quality, standardized portions, economic preparation, and minimum labor cost. An automatic barbecue, automatic biscuit baker, all-mechanical fryer, self-operating toaster, and automatic sandwich maker, plus many service inventions, make these lunches unique.

SAFEST PLACE TO EAT. Health regulations at the New York World's Fair make it the safest place in the world to eat. Structural requirements, and those for plumbing, equipment, food, food handling and inspection, custard filled products, cleaning and general sanitation, and examination of food handlers are outlined as they appear in regulations for all restaurant operators.

BETTER TEA AND COFFEE SERVICE. Coffee is the most popular beverage on hotel and restaurant menus. For good coffee use a blend roasted sufficiently and as fresh as possible. Make the coffee in thoroughly clean equipment. Serve good cream—18–30%. Brew coffee for icing to twice the strength of the regular brew. Tea is the most profitable beverage. Prepare tea carefully and keep tea in air-tight containers to preserve its flavor. The Waldorf has an interesting tea service which offers variety, quality, and personal attention. Lists 29 teas offered to the public, classified and sub-typed under black, green, scented, and miscellaneous.

"IRRADIATED EVAPORATED MILK AS A FOOD FOR INFANTS"

Over a two-year period Grulee, Sanford and Lewison made a comparative study* of Irradiated and non-irradiated Evaporated Milks on 192 infants in a slum area of Chicago.

The investigators report the following findings:

STOOLS—"We can assume, therefore, that in a carefully controlled study there is no greater frequency of stools in infants fed the one type of milk than the other."

ANTIRACHITIC BENEFITS—"We were particularly impressed with the absence of rickets in the group of infants given irradiated evaporated milk . . . Certainly when 103 infants raised under the social conditions of this district show no clinical or roentgenologic signs of rickets, it speaks well for the antirachitic qualities of irradiated evaporated milk."

ECZEMA—"The frequency of infantile eczema was practically the same in each group as one would expect."

WEIGHT GAINS—"The average gain per month was the same in both groups (1.3 pounds per month)."

No differences were found in frequency of stools, incidence of eczema, nor in weight gains. Irradiation does not change evaporated milk in these respects.

Highly important among the advantages of Irradiated Evaporated Milk is the antirachitic protection which it automatically provides. No rickets was observed in the Irradiated Evaporated Milk group.

Using this Milk with Vitamin D Medicinals requires no change in dosage. Added assurance of successful antirachitic management is attained because the Vitamin D in Irradiated Evaporated Milk is an *integral* part of the infant's food, will not be overlooked, will reach the infant *automatically* in each feeding.

Where infants are not under medical supervision, as frequently occurs in underprivileged groups, Irradiated Evaporated Milk may well be considered indispensable. Here the Milk is frequently the only effective and dependable antirachitic regularly employed.

Irradiation gives the several licensed brands of evaporated milk these "plus values" without increasing its low cost.

A reprint of the Grulee-Sanford-Lewison study will be mailed at your request.

**Clifford G. Grulee, M. D., Heyworth N. Sanford, M. D., and Matthew Lewison, M. D., The Journal o Pedriatrics, Vol. 14, No. 6, June, 1939. Pages 725-729.*

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NEWS NOTES

The Twenty-Second Annual Meeting of the American Dietetic Association, Los Angeles, August 27–31. Amidst glorious sun-drenched days and clear starlit nights, all of which more than met expectations, the twenty-second annual meeting of the American Dietetic Association convened at the Ambassador Hotel in Los Angeles on August 27.

A foretaste of beautiful California weather had been gained at the "Day in San Francisco", under the chairmanship of Mrs. Gwen Wedlake, where a large and enthusiastic gathering of dietitians assembled for luncheon at the Yerba Buena Club, the women's club on Treasure Island in San Francisco. The Hawaiian motif was in evidence here in the table decorations, the leis worn by the guests, and the music. As at later luncheons and dinners of the Association, the fruits and vegetables for which California is famed were lavishly used and even surpassed the anticipation of those who were seeing California for the first time.

Delegates began to gather in Los Angeles on the Saturday preceding the week of formal program, and the Executive Board went into session at 9:30 a.m. In the afternoon, members of the Executive Board and others were entertained at tea in the patio of the hotel by a group of California dietitians.

On Sunday afternoon early arrivals and officers of the Association were again entertained at a tea at the Miramar Hotel, Santa Monica, as guests of the Home Economics Association. Others had the interesting experience of attending a broadcast at the N. B. C. studios, as guests of Standard Brands Inc. To complete the program for the first day the Trips Committee had arranged other sight-seeing expeditions for the evening.

The Opening Session on Monday found the Fiesta Room filled with an enthusiastic audience to hear Dr. Eaton M. McKay in a scholarly discussion of "Obesity". At the Welcoming Luncheon following, held in the beautiful Cocoanut Grove of the Ambassador Hotel, with Katharine Brown presiding, greetings were extended by: Helen E. Walsh, president, California Dietetic Association; Dr. Lowell S. Goin, speaker of the House of Delegates, California Medical Association; Mr. R. E. Heerman, superintendent, California Hospital, Los Angeles; Dr. B. M. Allen, University of California at Los Angeles; Bruce A. Findlay, supervisor, Visual Education, Board of Education, Los Angeles; and Mr. David Wark Griffith, whose many inventions and pioneering work in the motion picture field, including the production of the famous "Birth of a Nation," have gained for him a position of world renown. Dr. Goin, speaking for the 6000 members of the California Medical Association, greeted the dietitians as colleagues and co-workers and said, "Physicians must look to dietitians as leaders in the field of nutrition and applied dietetics". He believed that the A. D. A. might well take steps to combat the extensive dietary misinformation now emanating from the radio and certain publications. He stated that the Association might thus sponsor a national syndicated column on diet to which the public might turn for authentic information.

At the Annual Business Meeting in the afternoon the following officers were elected: president-elect, Mary I. Barber; vice-president, Katharine Brown; treasurer, Margaret Cowden; Nominating Committee, chairman, Lenna F. Cooper, Nell Clausen, Fern Gleiser, Jennie Rowntree and Adeline Wood. In the House of Delegates, Nell Clausen of Wisconsin was elected chairman and Millie Kalsem of Illinois, secretary. Newly appointed officers for sections and committees appear under the list of officers of the A. D. A.

At the evening General Session with Mrs. Beula B. Marble, president-elect, presiding, papers were presented as follows: "Preserving the Dietetic Value of Frozen Foods", Mr. E. M. Chace, principal chemist, Laboratory of Fruit and Vegetable Chemistry, U. S. Department of Agriculture, Los Angeles; "The Use of the Elimination Diets in the Diagnosis and Treatment of Food Allergy", Albert H. Rowe, M.D., Oakland, California; and "The Dietitian's Place in the Hospital Research Program", Agnes Fay Morgan, Ph.D., chairman of the Division of Home Economics, University of California.

On Tuesday morning a large group consisting of heads of Home Economics Departments and directors of Approved Training Courses met

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Wake up the appetites of your "bluest" patients by using Syracuse True China.

This high quality, gleaming china — in its many attractive patterns helps to give a cheerful and homelike atmosphere to rooms and wards.

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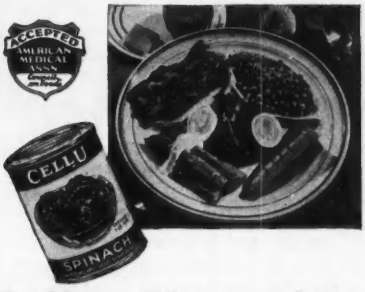
Syracuse True China will also help you reduce replacement costs. Its strong, vitreous body stands hard wear and is sanitary — an important feature in hospitals and institutions. Its glaze is unconditionally guaranteed against cracking or crazing.



Cellu Vegetables

without salt or seasoning

Packed especially for low carbohydrate diets and diets limited in salt. Cellu Vegetables provide an all-year-round selection, ready for instant use. Write for free sample and catalog.

Asparagus	Mushrooms
Beans	Peas
Beets	Rhubarb
Carrots	Spinach
Corn	Tomatoes

Vegetable Combination

CELLU LOW CARBOHYDRATE *Dietary Foods*

CHICAGO DIETETIC SUPPLY HOUSE, Inc.
Chicago

"Quaker" Cereals Mean

BETTER NUTRITION AT LOW COST

Quaker Oats and Mother's Oats are well known and widely used for all three meals, from soup to dessert and from morning until night. Their economy, delicious flavor, high food value, suitability in a wide variety of dietaries, and their uniformly high quality are thoroughly appreciated by thousands of institutional directors.

Oatmeal is this country's primary Whole-Grain Food. Quaker and Mother's Oats are excellent for "Breakfast-Cereal" and in literally dozens of other dishes to add taste variety and rich economical nourishment. For example:

1. *Quaker's Vegetable Soup*
2. *Quaker's Prune Oat Whip*
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4. *Quaker's Orange Torte*

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for breakfast with Helen S. Mitchell, chairman of the Professional Education Section, presiding. The session of the Community Education Section followed, with Helen E. Walsh presiding, and a General Session with Elizabeth W. Hayward presiding and the following program: "A Woman Behind It", Grace V. Merrill, supervisor of Dining Service, Union Pacific Railroad; "This Business of Eating", Mary I. Barber, director of Home Economics Department, The Kellogg Company; "School Lunchrooms—Whither Away", Arthur A. Knoll, business manager, Long Beach Board of Education.

The Exhibitors' Luncheon, an annual event always of great interest, was held on Tuesday noon with Isabel N. Young, American Can Company, New York City, presiding, and Mr. Harold J. Boyd, comptroller of the City of San Francisco, speaking on "Dietetics of Democracy". The beautifully decorated tables featured red roses supplied by the Portland, Oregon, Chamber of Commerce, and favors provided by the dietitians of the Northwest.

At the afternoon General Session with Margaret Terrill of the University of Washington presiding, vitamins and their functions, and dietary deficiencies were discussed by a notable group consisting of E. Neige Todhunter, Ph.D., associate professor of nutrition, Agricultural Experiment Station and College of Home Economics, State College of Washington; Margaret L. Fincke, Ph.D., associate professor of foods and nutrition, Oregon State College; Herbert M. Evans, M.D., Institute of Experimental Biology, University of California; and Martha Potgieter, Ph.D., associate professor of home economics, University of Hawaii.

On Tuesday evening arrangements had been made for a large block of seats for members of the Association attending the opera "Prince Igor" at the Hollywood Bowl.

Another pleasant annual custom was carried out on Wednesday when various groups met for hospital reunion breakfasts, followed by a session of the Professional Education Section with Helen S. Mitchell, chairman, presiding.

At the General Session following, with Charlotte Sloan of Stanford University Hospital presiding, a well rounded program was presented as follows: "Making the Most of Health Education Media", James G. Stone, executive secretary, Los Angeles Tuberculosis and Health Association; "Diet and Resistance to Tuberculosis", Kathryn Tissue, professor of dietetics, University of Kansas; and "Theory and Practice in the Dietetics of Bright's Disease", Thomas Addis, M.D., professor of medicine, Stanford University.

A luncheon of state presidents with Mrs. Beula B. Marble presiding, was attended by a large group of representatives from the affiliated states, and other countries. Another group, consisting of state bulletin and state publicity chairmen, with Edith Barber presiding, met at the same time.

At the afternoon General Session with Mrs. Jessamine C. Williams presiding, a large group gathered to hear Dr. W. D. Sansum, The Sansum Clinic, Santa Barbara, speak on "The Present Treatment of Diabetes Mellitus". A discussion followed and a question and answer session led by Mary W. Northrop.

The remainder of the day was given over to the session of the Administration Section with Grace Bulman presiding, and dinners for special groups: children's hospital; college food service; consultation work and private clinics; food clinics; large hospitals; private mental hospitals; public health and welfare work; public hospitals; school lunchrooms; small hospitals; and the teaching of medical and dental students.

On Thursday, the final day of the formal sessions, groups met for college reunion breakfasts, followed by the session of the Diet Therapy Section with Frances MacKinnon presiding. Following the reports of committee chairmen, the question "How Can the Activity of the Diet Therapy Section Be of Help in Furthering the Intelligent Use of Food as a Therapeutic Agent?" was discussed by a panel.

At the final General Session, at which Mary W. Northrop presided, new and old phases of the dietitian's work were discussed by the following: Arlien Johnson, Ph.D., dean of the Graduate School of Social Work, University of Southern California; Effie I. Raitt, director, School of Home Economics, University of Washington; and Mr. A. C. Jensen, superintendent, Fairmont Hospital of Alameda County, San Leandro.

As the final social event the California dietitians had arranged a Spanish Fiesta for Thursday evening. With Anna M. Tracy presiding, hundreds gathered in the Fiesta Room of the Ambassador where a typical menu of Spanish

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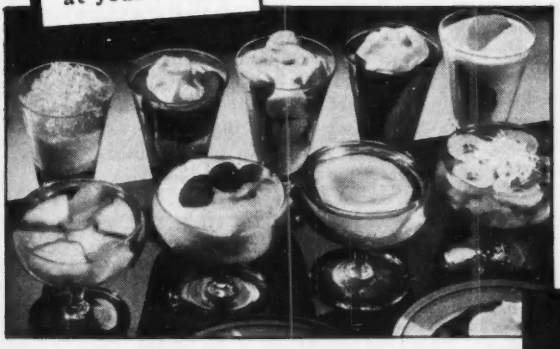

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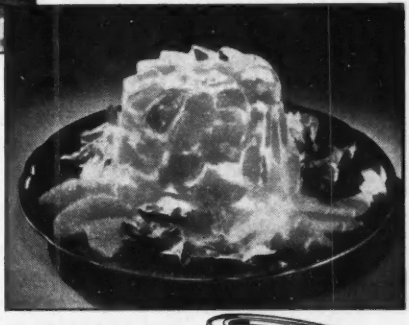

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dishes was provided, with musicians and dancers garbed in Spanish costumes typical of old California days. California's flowers and fruits were lavishly used in the table decorations, and Marion Parks, the speaker, gave an interesting account of the early days in California. Another pleasant feature of the evening and one which indicated the world-wide bond which now exists between dietitians, was a transcribed broadcast from Australia in which Australian dietitians took part.

Thus the first meeting of the A. D. A. on the Pacific Coast will be distinguished for its surprisingly large attendance at a place so far from the center of eastern population and for its sequence of delightful, sunshiny days. Neither fog, rain, nor unpleasant heat marred the enjoyment of the nearly 1000 dietitians, guests and exhibitors. The program, under the capable direction of Mary Northrop, was remarkable in its adherence to schedule and for its total absence of last minute substitutions. The various committees, with Katharine Brown as Local Arrangements chairman, likewise attended to the heavy task of entertaining the visitors with efficiency and friendliness characteristic of the state of California.

Radio broadcasts during the week consisted of the following: On Saturday at 9:30 a.m., Edith Barber, national publicity chairman, was interviewed by Margaret Ritchie over station KRX, Los Angeles. On Monday at 8:00 p.m., Anna M. Tracy, Mary I. Barber and Lenna F. Cooper were interviewed over station KFI. On Wednesday at 9:30 a.m., station KHJ presented a round table discussion by Anna M. Tracy, Mary I. Barber, Dr. Marietta Eichelberger, Frances MacKinnon and Joan Woodhill. On Thursday at 9:30 a.m., Dr. Helen S. Mitchell, Maniza Moore and Edith Barber were interviewed over station KHJ.

American Home Economics Association. At the June 19–23 meeting of the association in San Antonio, Texas, about 1700 were registered. At the birthday luncheon in honor of the association's 30th birthday, life memberships were granted to 12 charter members who have been continuously active in the work of the A. H. E. A.: Benjamin R. Andrews, Sarah Louise Arnold, Anna Barrows, Josephine T. Berry, Anna M. Cooley, Mary E. Gearing, Emma S. Jacobs, Annie Laird (posthumous), Abby L. Marlatt, Emma Smedley, Marion Talbot and Mary Shenck Woolman. Dr. Helen Judy Bond of Teachers College, Columbia University, continues in office as president. Officers elected were as follows: president-elect, Dr. Gladys Branegan, Montana State College; vice-president, Day Monroe, U. S. Bureau of Home Economics; recording secretary, Mrs. Dora S. Lewis, supervisor of home economics in Seattle, Washington; and councilor-at-large, Mildred Horton, Texas state home demonstration agent. The association will meet in Cleveland during the week of June 23, 1940.

Institute on Dietetics. The New York State Dietetic Association is cooperating with the State Department of Health, and the Syracuse University College of Medicine and College of Home Economics in a 4-day institute on dietetics to be held at Syracuse, New York, under the auspices of the Council Committee on Public Health and Education of the Medical Society of the State of New York. An interesting feature is that each topic on the program will be discussed by a physician and a dietitian. After a general consideration of diet the discussion will concern diet in special conditions, deficiency diseases and other functional and metabolic diseases. Further information may be obtained from Dr. Thomas P. Farmer, chairman of the committee, 206 Sedgwick Drive, Syracuse.

International Hospital Congress. This congress, scheduled for September 19–23 in Toronto, was cancelled because of the European war.

American Public Health Association. The sixty-eighth annual meeting will be held in Pittsburgh October 17–20 with headquarters at the William Penn Hotel. Among the symposiums announced are those concerning nutrition and food poisoning.

Surplus Food for School Lunches. The U. S. Department of Agriculture announces that a program providing free lunches for undernourished school children, promoted in 14,000 schools in 1938, will be expanded during the coming term to serve five million children. The Federal Surplus Commodities Corporation,

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the W. P. A., and local educational and welfare agencies will carry out the program.

Nutrition Conference. The first nutrition conference for all professional and lay groups in New York State interested in human nutrition met at the College of Home Economics at Cornell University July 17–22 under the cooperative auspices of the college and the New York State Departments of Education, Health and Social Welfare in Albany. Dr. Elizabeth M. Gardiner, director of the Division of Maternity, Infancy and Child Hygiene of the State Department of Health and special agent for the U. S. Children's Bureau, was chairman of the committee. The program for the meeting appeared in this JOURNAL for August-September. As an opening feature of the conference, Dr. Gardiner was interviewed over station WESG by Mrs. Kathleen H. Small, in charge of publications and information service of the college. During her 15-minute broadcast she gave an outline of nutrition work in New York and told her listening audience of the part the New York State Department of Health plays in individual and community nutrition.

Dr. Flora Rose, director of the college, who gave the opening address, "The Family Approach to Nutrition", said in part: "As I see it the school nutrition program must be broadened to include the adult as well as the child. We must include the family as well as children if we are to be successful in our nutrition program of education. This program must begin earlier with children and should be carried on through the first six years of school."

Dr. Helen Monsch, following, said, "We in the foods and nutrition department believe there is both a scientific and artistic aspect to this problem of feeding, so we plan courses—some of which deal mainly with the scientific aspect and some with the artistic, and we hope that students before they leave Cornell will have some appreciation of both."

Dr. Gardiner, speaking on "Indices of Good Nutrition", said in part: "Indices of nutrition are needed by the physician to assist him in determining a state of latency or pre-clinical disease and thus prevent its occurrence or further progress, and its ultimate disastrous effects. They are needed to enable agencies or governmental units properly to assess the nutritional adequacy of a nation, a community, or certain groups of a community, and to take action based on knowledge rather than propaganda. Scientists are working and reaching understandings that give hope of arriving at more accurate means of judging in a not too distant future. A few of these are that nutritive failure need not indicate a failure of supply but of utilization; that nutritional inadequacy is seldom a shortage of one element; that any abnormal condition in the alimentary tract alters adversely the ability to use essential food elements fully; that there is recent recognition of the importance of the balance between vitamin requirements and energy output and how easily it can be altered. An outright deficiency disease is usually self-evident, but as educators, social workers, nurses, physicians, what we want to be able to do is to recognize the border-line cases and set corrective action in motion before serious damage is done."

On the third day of the session a special broadcast was given over station WESG to show how the New York State College of Home Economics and the Division of Public Health Education of the State Department of Health operate in disseminating health education throughout every community in the state. Those who took part were Dr. Helen Monsch of the college, Leon M. Woodworth, assistant in Public Health Education of the State Department of Health, Albany; and Mrs. Small.

Speaking on the subject "Feeding Little Children in the Family Group", at the third session, Dr. Monsch said she wished to emphasize that right food is important in the lives of individuals but that food alone is not the only requisite to good nutrition. Individuals must have companionship, fresh air, exercise, outdoor life, sunshine, and a happy common environment to make for healthier, happier human beings.

Marian Pfund and Mrs. Pearl Janssen, both of the New York State College of Home Economics, gave talks on "The Preparation of Vegetables", stressing that most important of all in vegetable cookery is to be sure we are conserving all the vegetable's innate goodness. "If we select boiling as the method of cooking, the length of the cooking period and the amount of water used are both of great importance. We place the vegetable in rapidly boiling water and cook it as short a time as possible in order to make it tender, recognizing the fact that the longer we cook it, the more soluble nutritive

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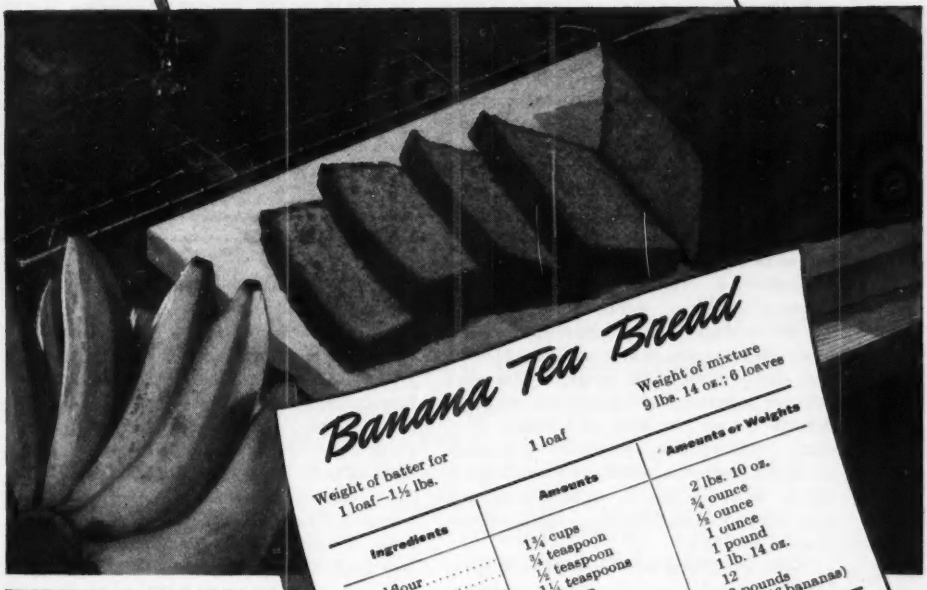

Banana Tea Bread

Weight of batter for 1 loaf—1½ lbs. | 1 loaf | Weight of mixture 9 lbs. 14 oz.; 6 loaves

Ingredients	Amounts	Amounts or Weights
Sifted flour	1¾ cups	2 lbs. 10 oz.
Soda	¾ teaspoon	¾ ounce
Salt	½ teaspoon	½ ounce
Cream of tartar	1¼ teaspoons	1 ounce
Shortening	½ cup	1 pound
Sugar	⅔ cup	1 lb. 14 oz.
Eggs, well beaten	2	12
Mashed banana* (peeled weight)	1 cup (2 to 3 bananas)	3 pounds (14 to 16 bananas)

**For full, rich flavor, use all-yellow or fully ripe bananas*

Sift together the flour, soda, salt and cream of tartar. Cream shortening. Add sugar gradually and beat until light and fluffy. Add eggs and beat well. Add flour mixture, alternately with mashed banana, a small amount at a time. Beat after each addition until smooth. Place in well-greased loaf pans and bake in a moderate oven (350° F.) about one hour, or until bread is done.

NOTE: This banana bread has a "cake-like" texture and flavor, and could be used as a substitute for cake.

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matter will be lost. We start all vegetables in boiling water because the air is driven out when water boils. When the vegetables are put into the water, the enzyme that acts in the destruction of vitamin C (ascorbic acid) is quickly killed, so less of the vitamin tends to be destroyed than if the vegetable is started in cold water. Whenever consistent with good color and flavor, we cover the pan during the cooking and keep the quantity of water so small that it can be served with the vegetable. We do not use soda to retain the green color of vegetables as soda destroys flavor, makes texture unpleasantly soft and destroys vitamins B and C."

In the evening a dinner was held in Willard Straight Hall with Dr. Monsch presiding, and Sybil Smith, senior experiment station administrator, Office of Experiment Stations, U. S. Department of Agriculture, Washington, speaking on "Nutrition—An International Problem".

Civil Service Examinations for Dietitians. Announcement was received, too late for inclusion in the August-September JOURNAL, concerning these positions, applications for which had to be on file in Washington not later than September 5–8. The examinations were for the following positions: Public Health Service, Federal Security Agency; appointment made in all cases to grade of staff dietitian, $1,800 a year, higher grades filled by promotion; when quarters, subsistence and laundry are available, deduction of not over $690 will be made. Veterans' Administration, appointment and salary as above, deduction $480. In other departments, vacancies were to be filled in government agencies as staff dietitian, head dietitian, or chief dietitian.

Duties were listed as follows: chief dietitian ($2,300 a year) to act in advisory capacity, cooperating with physicians in dietetic treatment of patients, and to plan, supervise and direct preparation and service of hospital dietaries; head dietitian ($2,000 a year) to have charge of preparation and service of food from main kitchen, to supervise preparation and service of specific diets, to cooperate with physicians concerning dietetic treatment of patients, to have entire charge of dietetic service in hospital having capacity of less than 100 beds; staff dietitian, under supervision of head dietitian or chief dietitian, to perform similar and related duties as assigned.

Detroit Diabetes Association has prepared and published a pamphlet entitled "A Compend of Diabetes Mellitus." This group consists of active members who are leading physicians of Detroit, and an advisory council in which representatives of the field of medicine, surgery, ophthalmalogy, dentistry, nursing, dietetics, obstetrics, social service and public health, participate. Mary M. Harrington of Harper Hospital, Detroit, is the representative of the dietetic profession. The information is concise and complete. The following brief excerpt from the contents, under the heading "Who shall interpret the diet prescription in terms of food?", shows the attitude of this group toward the work of the dietitian with the diabetic: "The physician, in general, has neither the time, training nor facilities for writing dietary menus. A dietitian should translate the physician's prescription and plan menus that fit the social, racial, religious and economic situation of the particular patient. In this community, services of a dietitian are available as follows: (1) Dietitian at City Physician's Office, (2) Dietitian with Visiting Nurse Association, (3) Dietitians at various hospitals."

An Institute on Blood and Blood-Forming Organs was held at the University of Wisconsin Medical School, Madison, September 4–6. Among the speakers were the following: Dr. L. J. Witts, Oxford, England, "Anemias Due to Iron Deficiency"; Dr. E. Meulengracht, Copenhagen, Denmark, "Some Etiologic Factors in Pernicious Anemia and Related Macrocytic Anemias"; Dr. Russell H. Haden, Cleveland, "The Nature of the Hemolytic Anemias"; Dr. George R. Minot, Boston, "Anemias of Nutritional Deficiency"; and Dr. Paul Reznikoff, New York City, "Polycythemia".

Conference of Food Service Directors. The program for the Fifth Annual Conference to be held at the Lord Baltimore Hotel, Baltimore, November 2–4, will include, in addition to features previously announced in this JOURNAL, the following: Reports on "The Playroom Type of Elementary Lunchroom", by Helen Southworth, assistant supervisor, Department of School Lunchrooms, Board of Education, Detroit; and "The Layouts of the Detroit and Cleveland High Schools", by Margaret Zimmerman of Detroit and Mary Hemmersbaugh of Cleveland.

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The program is under the direction of Elisabeth Amery, state supervisor of home economics education, Maryland. On November 2 a trip will be made to the United States Naval Academy. There will be a conducted tour of the academy kitchens and a visit to the Maryland Government House where Governor Herbert R. O'Conor and Mrs. O'Conor will receive the guests.

Diet Guide for Private Institutions. The Department of Institutions, State of California, A. J. Rosanoff, M.D., director, has just issued a basic diet guide as an aid in serving palatable and balanced meals. The guide was formulated by Jane Sedgwick, food administrator for the Department of Institutions, State of California, and was approved by two members of the teaching staff of the University of California. The material, in brief, covers the nutritional needs of the adult, dietary standards for private institutions, and quantity of food required in amounts necessary to serve ten adults for one meal or ten children for one meal. Other helpful data include sanitation of the kitchen and dining room, pointers for food preparation, high cost and low cost adult menus, menus for school-age child, basic liquid diet, basic soft diet, and basic menu as a guide for the soft diet.

Poultry Cooking Charts. The Bureau of Home Economics, U. S. Department of Agriculture, has prepared a set of eight poultry cooking charts, size 20 x 30 inches, printed in black and white on heavy paper. The set is priced at 50 cents and may be ordered from the Superintendent of Documents, Government Printing Office, Washington, D. C. Cash, money order or certified check must accompany order. The Bureau is also distributing a folder on poultry cooking, including approved methods for broiling, frying and roasting, complete detailed recipes, and time-table for roasting.

Descriptive Labeling. At the June meeting of the National Association of Retail Grocers in Kansas City, a resolution was adopted favoring "descriptive" labeling in preference to grade labeling of canned goods.

Summertime Recipes. The Home Economics Division of the National Canners Association is distributing the third of their series featuring family sized recipes for the use of canned foods, copies of which are available upon request at the headquarters in Washington, D. C.

Dietitian Appointed at Wallum Lake State Tuberculosis Sanatorium, Rhode Island. Mrs. Katherine Bailey Heilmann has recently been appointed the first dietitian at the sanitorium, the appointment being made by Dr. Lester Rounds, director of the Rhode Island Department of Health. Mrs. Heilmann graduated from the Texas State College for Women and did postgraduate work at the University of Oklahoma. She was a student at the University of Michigan Hospital under Margaret Gillam, and was formerly connected with the Gorgas Hospital, Panama Canal Zone.

Frances MacKinnon, chairman of the Diet Therapy Section of the A. D. A., formerly of University Hospital, Ann Arbor, Michigan, and now of the New York Hospital, New York City, was the junior author of a paper entitled "The Influence of Iron and Diet on the Blood in Pregnancy" appearing in the July *Annals of Internal Medicine.*

Lenna F. Cooper, past president of the American Dietetic Association and chief, Department of Nutrition, Montefiore Hospital, New York City, is the author of a paper on "Food Service" in the June *Bulletin* of the American College of Surgeons. The paper was presented before the Hospital Conference, Clinical Congress, American College of Surgeons, October 20, 1938.

Inez Somers, home economist, General Baking Company, bakers of "Bond Bread", was the guest speaker on the program of Mrs. Frances Foley Gannon, director of the Bureau of Consumers' Service for the City of New York, over station WNYC, July 18. Miss Somers spoke on the timely topic of "Picnics".

Doris Longman, formerly head dietitian, St. Mary's Hospital for Children, New York City, and Mrs. Charles Alcorn, formerly on the staff of the Jewish Hospital, Brooklyn, are now members of Miss Espey's staff at Memorial Hospital, New York City.

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Massachusetts Dietetic Association. The report of the Boston Budget Council, "Budgeting the Low Income", has been revised and is being printed. Blanche Dimond, chairman of the council, announces that copies of the pamphlet are available from the Community Health Association, 137 Newbury Street, Boston.

Helen Perry, formerly community nutritionist at Quincy, Massachusetts, has been awarded a fellowship at the Banting Research Foundation, Toronto, Canada. Her work will begin in September, and will be in the field of vitamin research under the direction of Dr. E. W. McHenry of the School of Hygiene, University of Toronto, and Canadian National Council.

Ruth L. White, Forsythe Dental Infirmary, recently spoke to a group of forty Michigan school superintendents who had been sent by the W. K. Kellogg Foundation to the Massachusetts Institute of Technology for a public health institute.

Esther Leiberman of the University Hospital, Ann Arbor, Michigan, spent two months recently as a student with the Community Health Association.

Diamond Ballin, a graduate of the Isabella Thorburn College, India, who studied nutrition at Simmons College this year, acted as relief dietitian during the summer at the New England Deaconess Hospital.

Alice Van Dyke resigned as dietitian at Heywood Memorial Hospital, Gardner, Massachusetts, to conduct a tea room and catering business at Meredith, New Hampshire.

Cards have been received from Mr. and Mrs. Dignan of Portland, Maine, announcing the birth of a daughter, Judith Lee. Mrs. Dignan (Grace Cahill) was formerly a member of the dietetic staff of Danvers State Hospital, Danvers, Massachusetts.

Josephine Hoffman has accepted the position as therapeutic dietitian at the New England Baptist Hospital. Miss Hoffman comes to Boston from the Mary McLellan Hospital in New York.

Jean Bernard of Gloversville, New York, was a relief dietitian at the Boston Lying-in Hospital during the summer.

Ruth Button has accepted the position of assistant administrative dietitian at the Children's Hospital, Boston.

Miss Lowe, a graduate of the Peter Bent Brigham Hospital, has accepted a position as assistant dietitian at Skidmore College.

Arlene Fulton, dietitian at the Deaconess Hospital, was married to Dr. Charles P. Fortin of New Bedford, at Charlottesville, Virginia, July 14. They will reside at 340 Court Street, New Bedford. Mary Elizabeth Randolph, formerly of the House of Mercy Hospital, Pittsfield, replaced Miss Fulton at the Deaconess Hospital.

Polly Estil, formerly of the Children's Hospital, has accepted a position on the dietary staff of University Hospital, Ann Arbor, Michigan.

Katherine Wismer, who graduated from South Dakota State College and received her M.A. degree at the University of Iowa, is now dietitian on the research ward of the Massachusetts General Hospital.

Marie Benson, formerly assistant dietitian at the Baker Memorial, Massachusetts General Hospital, is now at the Children's Hospital, Cincinnati.

Nellie Burns and Helen Baclawski, both Massachusetts General Hospital graduates of this year, have positions. Miss Burns is at the New England Medical Center in Boston and Miss Baclawski is at the Howard State Hospital in Providence, Rhode Island.

Martha Brothers, formerly assistant dietitian at Michael Reese Hospital, is replacing Mrs. Barbara Hill who resigned her position at the Beth Israel Hospital.

Minnesota Dietetic Association closed the official year meeting jointly with the state hospital association in St. Paul, May 26. At a separate group meeting the following program was presented: "Some Reorganization of a Hospital Food Administration System", Lottie Crecelius, St. Mary's Hospital, Rochester; "Early History of Nursing Bottles", Robert Rosenthal, M.D., St. Paul; "Rôle of Dietetics in the Treatment of Neuro-Psychiatric Disorders", Gordon R. Kamman, M.D., University of Minnesota.

The following officers were elected for 1939–1940: president, Hazel Brown, Vocational Hospital, Minneapolis; vice-president, Lorene Kulas, Ancker Hospital, St. Paul; treasurer, Elizabeth Schofield, Miller Hospital, St. Paul; recording secretary, Chrissa Wendt, St. John's Hospital, St. Paul; and corresponding secretary, Marie Fahey, Glen Lake Sanitarium, Oak Terrace.

At the annual dinner meeting at the King

METHODS FOR QUANTITATIVE ESTIMATION OF THE VITAMINS

1. The Determination of Vitamin D Activity

● About fifteen years ago it was clearly established that there could be present in certain foods or biological materials some substance which possessed antirachitic potency. Subsequently this "antirachitic factor" became known as vitamin D. Today, we know that at least ten sterol derivatives may exert antirachitic effects closely comparable to those of the originally discovered vitamin D (1).

Recognition of the existence of the antirachitic vitamin naturally stimulated investigation of methods whereby this dietary essential could be quantitatively estimated. Steady advances in knowledge of the causes and effects of rickets brought gradual improvements in these methods. Consequently, there are now available several techniques for the quantitative determination of vitamin D in foods or other biological materials.

The first and probably most widely employed method for estimation of vitamin D is by means of the so-called "line test" (2). In this technique as now employed (3), young rats are confined for 18 to 25 days to a diet conducive to development of rickets. These periods of time, with proper handling and confinement of the animals, are sufficient to induce a definitely rachitic condition. The rachitic rats are then properly grouped with respect to negative control groups to receive no supplements to the rachitic ration; positive control or reference groups to receive graded doses of some standard reference material; and "assay groups" to be given graded doses of the material under test. For the next 8 days the animals are fed daily doses of the proper supplement, either assay or reference material. No supplements are fed on the ninth and tenth days.

On the eleventh day the animals are sacrificed and either the proximal end of the tibia or the distal end of the radius or ulna dissected out, sectioned, cleaned and finally immersed in silver nitrate solution. By double decomposition reaction, silver salts deposit where calcium is present in the metaphysis of the bone. When exposed to light these silver salts are reduced and form a dark line indicating the extent of calcium deposition. The experienced technician can estimate the degree of healing from rickets by the continuity and area of the line. By comparison of the results obtained on the various groups of animals, a quantitative expression of the antirachitic activity of the material under assay may be obtained.

A second method for evaluating vitamin D activity is that involving determination of "bone ash" (4). In this technique, final estimation of the degree of bone calcification—and thus the antirachitic potency of the substance under assay—is made by chemical analysis of specific bones of the experimental animals. A third assay method (5) is that involving roentgenological examination of certain bones. Comparisons of the bone densities of the various experimental animals serve as a basis for estimating the degree of healing from—or prevention of—rickets and hence permit determination of the vitamin D activity of the material under test.

Common foods as they naturally occur can hardly be considered as food sources of vitamin D. However, as exceptions, certain foods of marine origin (6) might be mentioned which consistently contribute small but definite amounts of the antirachitic factor to the diet. In addition, development of various means of fortifying foods with vitamin D—particularly those foods of importance in infant and child feeding—has made available other food sources of the vitamin (7). Among the many varieties of commercially canned foods will be found products of both types, which, when properly used or supplemented, should prove of value in obtaining an adequate intake of vitamin D, particularly by infants and children.

AMERICAN CAN COMPANY
230 Park Avenue, New York, N. Y.

(1) 1938. J. Am. Med. Assoc. 110, 2150.
(2) 1922. J. Biol. Chem. 51, 41.
(3) 1936. The Pharmacopeia of the United States of America, Eleventh Decennial Revision, 482.
(4) 1923. J. Biol. Chem. 58, 71.
1924. Ibid. 61, 405.
(5) 1928. Biochem. J. 22, 135.
(6) 1938. J. Am. Med. Assoc. 111, 528.
(7) 1937. J. Am. Med. Assoc. 108, 206.

We want to make this series valuable to you, so we ask your help. Will you tell us on a post card addressed to the American Can Company, New York, N. Y., what phases of canned foods knowledge are of greatest interest to you? Your suggestions will determine the subject matter of future articles. This is the fifty-second in a series, which summarize, for your convenience, the conclusions about canned foods reached by authorities in nutritional research.

ACCEPTED AMERICAN MEDICAL ASSN Council on Foods

The Seal of Acceptance denotes that the statements in this advertisement are acceptable to the Council on Foods of the American Medical Association.

(In writing advertisers, please mention the journal.)

Cole Hotel in Minneapolis, May 11, the association entertained Adeline Wood who was in Minneapolis visiting student training courses.

Ethel Gough, Minneapolis General Hospital, was married in December to Mr. Daniel Uhey. Anne Whitcomb, Mayo Clinic, Rochester, was married in April to Dr. Randall Sprague, a fellow in medicine of the Mayo Clinic. Betty Hume was married to Dr. John Black of the Mayo Clinic and is residing in Rochester.

Lucile Townsend is now in Utica, N. Y., as a consultant with the Slocum-Dickson Clinic.

Thelma Graves of Pokegama Sanitarium is now dividing her time between the Anoka and Hastings State Hospitals.

Doris Grand resigned from the Rochester Diet Kitchen and is now with St. Luke's Hospital in Chicago.

Marguerite Klobe has left Children's Hospital in St. Paul, and is now at Young America, Minnesota.

Margaret Pewters, formerly of St. Mary's Hospital, Rochester, is now at the Rochester State Hospital. Margaret Hunstiger, a graduate of the University of Minnesota, has been added to the staff at St. Mary's Hospital.

Joan Marie Durnan, former student of the Ancker Hospital, St. Paul, is now on the staff of the Children's Hospital, St. Paul.

Mary Foley of the Mayo Clinic, former president of the Minnesota Dietetic Association, spoke before the Canadian Dietetic Association in Winnipeg in July.

Pittsburgh Dietetic Association closed its program for the year with a picnic at South Park. Florence Peters, dietitian consultant, Department of Public Welfare, Harrisburg, Pennsylvania, was a guest. The following officers were elected for the coming year: president, Catherine Fry, Allegheny General Hospital; vice-president, Jenny Barton, Presbyterian Hospital; secretary, Audrey Oakley, Pittsburgh Dairy Council; treasurer, Clara Kurtz, Children's Hospital; chairman of Program Committee, Gladys Murray, Sewickley Valley Hospital; chairman of Membership Committee, Hester Griffin, Mt. Mercy College; chairman of Hospitality, Dorothy McNaughton, West Penn Hospital; chairman of Publicity Committee, Sylvia J. Levie, Pittsburgh City Hospitals, Mayview.

Dorothy Lenfest, business manager of the A. D. A., was in Pittsburgh on June 10 to meet with a committee of Pittsburgh dietitians to discuss convention possibilities for 1941.

Elizabeth Hartung, formerly assistant dietitian, Eye and Ear Hospital, is now chief dietitian of South Side Hospital, replacing Jean Hamley who resigned to be married and is now living in Lima, Peru.

Miss Lowney has resigned her position at the County Home, Woodville, Pa.

St. Louis Dietetic Association. "Professional Education" was the subject of the April meeting, with Louise Wilkonson presiding. Allah Meredith of Barnes Hospital discussed methods of teaching student nurses. Mrs. Gladys Silkey, St. Louis University Hospitals, related the teaching plan for students at Firmin Desloge Hospital, and Hazel Bradburn discussed her course for teaching practical nutrition to interns.

Ruth Kahn, Washington University Medical School, was in charge of the diet therapy program for the May meeting. Mrs. Marie Harrington, executive director of the St. Louis Dairy Council, showed health education films for use in schools and clubs.

During the St. Louis sessions of the A. M. A. in May, visiting dietitians were entertained at a luncheon by a group of local dietitians.

Mrs. Jane Leitch has accepted the position in charge of the employees' cafeteria at the Stix, Baer & Fuller Department Store.

Louise A. Walker of Jefferson Barracks has been transferred to Ashville, North Carolina.

Mrs. Patti Moulton is in Florida supervising a W.P.A. project in household-aid training.

Allah Meredith has resigned as teaching dietitian at Barnes Hospital to study for her master's degree at the University of North Carolina.

Mary Catherine St. Johns, graduate fellow in the St. Louis University Medical School Clinic, has received her master's degree in nutrition from St. Louis University.

Mildred Ewing accepted the position as dietitian in the St. Louis University Medical School Cafeteria.

Mrs. Gladys Silkey presented a paper "Planning Menus for the Child at Camp" before the February meeting of the American Camping Association, convening in St. Louis.

Mrs. Margaret West, formerly of Christian

In Addition to Vitamins A & D Every Glass Now Contains Child's Optimal Dosage of Vitamin B_1.

Cocomalt ADDS ANOTHER VITAMIN

COCOMALT has ever kept abreast of growing nutritional knowledge. Step by step, this famous malted food dietonic was improved . . . first fortified with Vitamin D and later supplemented with adequate amounts of Vitamin A, together with essential minerals.

And NOW every ounce of COCOMALT (taken in each 8 oz. glass of milk) contains sufficient amounts of the all-important Vitamin B_1 for the child's optimal dose . . . 75 International Units per ounce.

Yet the addition of this important vitamin has not increased the price. The palatability of COCOMALT is as good as ever.

SPECIAL OFFER TO TEACHERS

Dept. A-10

R. B. DAVIS COMPANY, Hoboken, New Jersey

Please send me the new Teacher's Manual, "A Modern View of Adequate Diet" combined with "Course of Study" Chart. I would also like a sample copy of the Pupil's Leaflet, "The Proud Story of a Humble Food".

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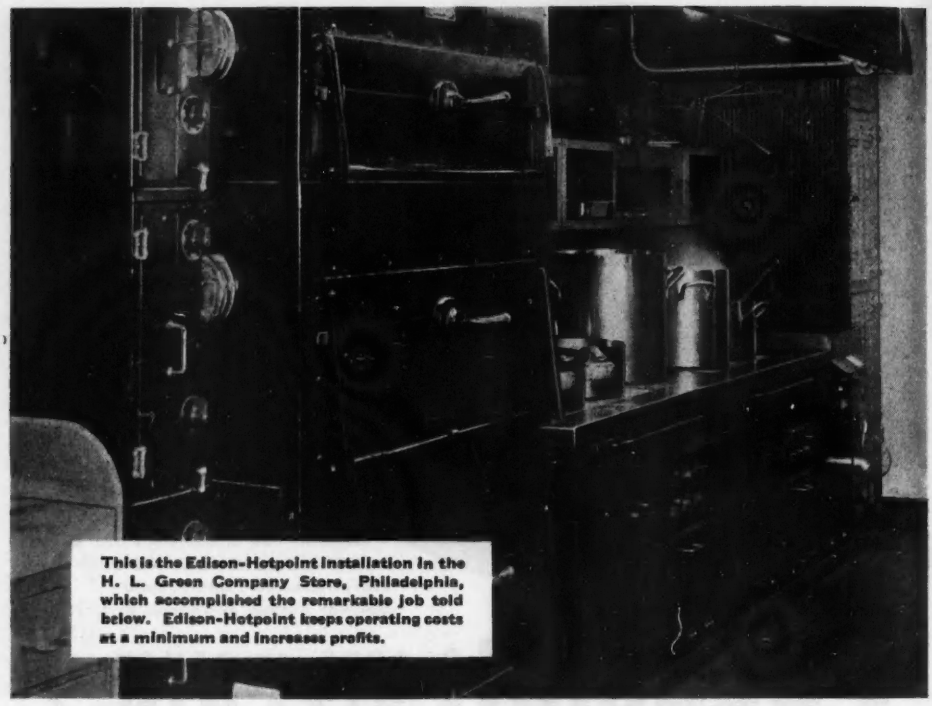

This is the Edison-Hotpoint installation in the H. L. Green Company Store, Philadelphia, which accomplished the remarkable job told below. Edison-Hotpoint keeps operating costs at a minimum and increases profits.

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Cuts Operating Cost

Despite a 400% increase over the original estimate of customers to be served, the Edison-Hotpoint installation in the H. L. Green Company store, Philadelphia, operated at less than half its planned quota of current consumption!

This is an amazing performance but what Edison-Hotpoint did for H. L. Green Company it can do for you. Smart restaurant owners all over the land are enjoying the same benefits. Major operating costs don't suffer from fuel costs "chiseling in" because Edison-Hotpoint banishes fuel waste.

Then too, you gain many advantages when you cook electrically. In most cases you enjoy a lower rate when you "do everything" electrically, than is the case when you cook with one fuel and use electricity for power and lighting only.

Take a hint from successful operators like the H. L. Green Company of Philadelphia. Climb on the profit wagon. Look into Edison-Hotpoint Electric Cooking and Baking equipment now.

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BAKING AND ROASTING

In this type of Edison-Hotpoint oven at the H. L. Green Company one baker produced 130 dozen biscuits, 35 ten-inch pies, 2 dozen pieces of Danish pastry and 2 twelve-inch shortcakes in less than eight hours.

WINDOW DEMONSTRATIONS

Appeal to the sense of sight by conducting demonstrations of electric cooking on a griddle like the one shown above. Enjoy extra profit which Edison-Hotpoint brings in increased customers and reduced operating costs.

EDISON-HOTPOINT ELECTRIC KITCHEN

Meets Overload Test

Serving 3600 customers a day with cooking equipment originally intended to handle only 900 people is truly an achievement. Yet with no increase in personnel the H. L. Green Company store in Philadelphia did just that during the Christmas rush with an Edison-Hotpoint complete electric kitchen.

But that's not all! They established a new low in operating costs because their entire Edison-Hotpoint Kitchen cost an average of less than half a cent per meal to operate!

The H. L. Green Company learned too, that electric cooking does not increase the kitchen temperature so noticeably as does cooking by other means. It creates no excess heat which must be removed. It takes a load off the air conditioning equipment—enables a smaller plant to do the job.

Investigate Edison-Hotpoint Electric Cooking and Baking equipment now.

DEEP FAT FRYING

It was in an Edison-Hotpoint Electric Fry Kettle such as this that the H. L. Green Company found new profits in tasty fried foods. *For the range bank*—Built to fit and harmonize with electric ranges in modern kitchen range bank.

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KITCHEN EQUIPMENT HOUSES

Hotpoint **COOKING EQUIPMENT**

Hospital, is directing a W.P.A. household-aid training project in St. Louis County.

Texas Dietetic Association. The *Bulletin* of this association continues under the editorship of Mamie Ruth Harris. Papers by members in the July issue included the following: "The Administrative Dietitian as a Residence Hall Food Service Director", Mary B. Clark, head dietitian and buyer for Southern Methodist University; and "The Dietitian as an Administrative Housekeeper", Grace M. Augustine, head, Institutional Management Division, Texas State College for Women, Denton.

South Texas Dietetic Association and guests enjoyed a picnic at Phenix Dairy Farm in April and a barbecue chicken dinner.

Blake Bryson Patrick was hostess for the May meeting of the association. After the business meeting a surprise silver shower was given honoring Inez Crawford, Methodist Hospital, Houston, who was married on June 4 to Mr. James New.

Mary Smith and Irene Pope Hardy attended the convention of the American Home Economics Association in San Antonio in June.

Wisconsin Dietetic Association. According to *The Wisconsin Dietitian* for August 1939, "The Dairy Lane to Dental Health" was a special feature planned by Wisconsin dietitians in cooperation with the State Department of Agriculture as an educational exhibit at the annual meeting of the American Dental Association in Milwaukee July 17–21. In the nutrition booth eight posters were shown. Beginning with artificial infant feeding, normal nutrition was illustrated through childhood to the normal adult at light work. Posters for the expectant and nursing mother and for the child who will not drink milk were also exhibited. Especially attractive and forceful were two posters, one picturing the equivalent in calcium of other foods to that in one quart of milk, and another entitled "The Protective Foods".

A booklet, "Dairy Products for Dental Health", compiled by the Wisconsin Dietetic Association and published by the Department of Agriculture, was distributed in the booth. Members of the association were present at all times to give nutritional information and to answer questions.

Ethel Keating, Breta Griem and Nell Clausen attended the committee meetings at which the exhibit was planned. Ada Lothe, Magna Werra, Grace Clark Ullmann, Pearl Hunkel, Katherine Lambert, Katherine Lees, Janet Wing, Agnes Walish, Dorothy Gramling, Doris Johnson, Anita Schaefer, Hedwig Poehler, Marie Ryan, Marian Kohlmann, Elinor Ellison, Frances Kelley, and Theresa Goetz assisted in the booth.

The Milwaukee Dietetic Association held its May meeting at the Keenan Health Center with Hedwig Poehler as hostess. The last meeting of the season was held at Sunset Point, Madison, where Milwaukee members renewed acquaintance with Madison dietitians.

Bernice Overton and Lottie Benedict, both of Columbia Hospital, have accepted positions in New Orleans.

Vivian Testa, formerly of St. Mary's Hospital, Rochester, is now at St. Joseph's Annex.

Grace Clark was married in June to Mr. George Ullmann. Mrs. Ullmann's position at Milwaukee County Hospital is being filled by Elinor Ellison, formerly of York Hospital, York, Pa.

Agnes Walish, formerly of Misericordia Hospital, is now at the Milwaukee County Hospital, replacing Mrs. Owen Royce, the former Olive Ludwig.

Among those attending the A. D. A. meeting in Los Angeles were Ada Lothe, Nell Clausen, Lillian Fried, Breta Griem, Dr. Helen Parsons, Sara Ellen Wenger and Ethel Keating.

Commercial Exhibits, American Dietetic Association, Los Angeles, August 27–31, 1939. Many of the following firms have interesting and educational literature and other information concerning their products available to members upon request.

The *Aluminum Cooking Utensil Company*, New Kingston, Pa., makers of "Wear-Ever" equipment, was featuring institutional utensils with smooth, flat, extra thick bottom, wide radius corners, double-thick sanitary edges smooth interior finish and seamless construction, all described in their booklet on institutional utensils.

The *American Can Company*, New York City, offered their new book, a canned food reference manual especially prepared for dieti-

FACTS

FRESH FROM THE OVEN, TO AIM AT FOOD FADDISTS

EVERY physician's practice includes one or more "food-faddist" patients who are still swayed by moth-eaten superstitions . . . such as the old-fashioned notion that white bread is automatically "fattening".

It is sometimes difficult to convince such people that no single food is fattening, and that, in themselves, two slices of bread at every meal will contribute only about 390 calories toward the usual daily requirement of 2,500—3,000 calories.

White bread can be, in fact, a proper part of modern *reducing* diets, and many physicians find this fine food useful for this purpose.

Fortunately, most normal people *like* this splendid and easily assimilated energy food, and need only the reassurance that it may be used in a well-balanced diet without producing "poundage", to enjoy its benefits to the full.

May we send you, without obligation a valuable booklet, "The Physician and Our Daily Bread", which offers clinicians the latest reliable facts concerning the food value of bread?

American Institute of Baking

DEPARTMENT OF NUTRITION

NINE ROCKEFELLER PLAZA • NEW YORK • N. Y.

tians and physicians. Isabel Young was in charge.

At the booth of the *Battle Creek Food Company*, Battle Creek, Mich., presided over by Mrs. Thelma Kelser, "Savita" was served, and many products displayed.

The *Borden Company*, New York City, showed many varieties of dairy products and featured institutional packaging. A new flavor idea in sherbet, dedicated to the members of the A. D. A., was introduced for the first time. Mabel Flanley greeted visitors at the booth.

California Dairy Council, which exhibited jointly with the National Dairy Council, of which it is a unit, has for its purpose "to promote optimum health and human welfare through adequate use of milk and its products in accord with scientific recommendations and thus contribute to a more secure national well-being." This is done through investigating and assembling basic research facts on dairy products, preparation and distribution of thousands of pieces of material—newspaper articles, feature stories for magazines, lectures, radio programs and the production of motion picture films, and attendance and exhibits at meetings of professional groups, health departments, the medical and dental professions, and other educational and consumer groups.

Ilma Lucas of the *California Food Research Institute*, San Francisco, representing several companies, featured "Calavo" avocados, alligator pears, colossal ripe olives, dried fruits, and "Heart's Delight" pear nectar.

Lyle Arnold and A. J. Lorenz joined Essie Elliott at the booth of the *California Fruit Growers Exchange*, Los Angeles, offering an unlimited supply of fresh "Sunkist" orange juice and literature.

"Carnation Irradiated Evaporated Milk" the largest selling brand in the world, and cold chocolate milk made from it, were featured by the *Carnation Company*, Oconomowoc, Wis.

Lida Jamison of the *Chicago Dietetic Supply House, Inc.*, Chicago, was showing their water and juice packed fruits.

The *Colson Corporation*, Elyria, Ohio, exhibited several interesting "Ideal" food conveyers and kitchen service trucks and equipment, and a cold beverage dispenser, a part of one of the hot food trucks.

Robert R. Helmerichs, of *Cream of Wheat Corporation*, Minneapolis, displayed the new "Cream of Wheat" which is quick cooking and fortified with iron, calcium, phosphorus and vitamin B_1.

The *R. B. Davis Company*, Hoboken, N. J., displayed "Cocomalt" which has taken another advance step in the addition of vitamin B_1 to this already popular product. They have also added more vitamin A. Its low fat content and solubility and delicious flavor and economy make it available for all types of hospitals.

Tray service of all kinds, including china, glassware, silver and trays was featured by Carl E. Farman, Jr., and John Strohn of the *Dohrmann Hotel Supply Company*, San Francisco.

The *Edison General Electric Appliance Company*, Chicago, showed heavy duty equipment and displayed literature, catalogs and charts.

The *Evaporated Milk Association*, Chicago, graphically displayed the relative composition and food values of evaporated milk and raw milk from which it is prepared. Publications for dietitians and general health workers may be obtained from Dr. Marietta Eichelberger, director of Nutrition Service.

J. B. Ford Sales Company, Wyandotte, Mich., showed their entire line of cleaning and sterilizing supplies for hospitals and institutions, featured under the "Wyandotte" brand.

The *Frosted Foods Corporation*, New York City, presented "Birds-Eye Frosted Foods", exhibiting a complete line of fresh fruits, vegetables and sea foods.

Bertha Nettleton, dietitian with *General Foods Corporation*, New York City, directed activities of the firm's exhibit. The institution department featured molded salads and desserts made from the "Jell-O" division.

Dr. Lillian Storms of *Gerber Products Company*, Fremont, Mich., showed their line of foods for babies and displayed helpful literature.

Genevieve Callahan of the *Golden State Company, Ltd.*, San Francisco, displayed bread made with dried milk solids, increasing the intake of protein, calcium, phosphorus and vitamins B and G.

Patricia Collier of the *Hawaiian Pineapple Company*, San Francisco, registered the names of dietitians for the Dietetic Recipe Service. Dole pineapple juice was also featured.

The *H. J. Heinz Company*, Pittsburgh, with Frances Peck in attendance, exhibited strained

The American Wage Earner's

DIET

Content - - - - - - - - - - - -

Cost - - - - - - - - - - - -

Nutritive Value - - -

Recently, the American Wage-Earner's diet has been subject to close inspection. U.S.D.A. Circular 507 reports a survey conducted on over 4000 weekly food consumption records, collected in homes of wage-earner families. Content, cost and nutritional value of the diets have been analyzed.

For dietitians who want a new "angle" on the job which faces their profession, we've prepared a booklet abstracting the data in U.S.D.A. Circular 507. If you'd like a copy, simply write or send a penny postcard to Vitex Laboratories, Inc., Harrison, N. J. Ask for "The American Wage-Earner's Diet."

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Producers of "Vitex" Vitamin D Concentrate for the preparation of "Vitex"* Vitamin D Milk.*

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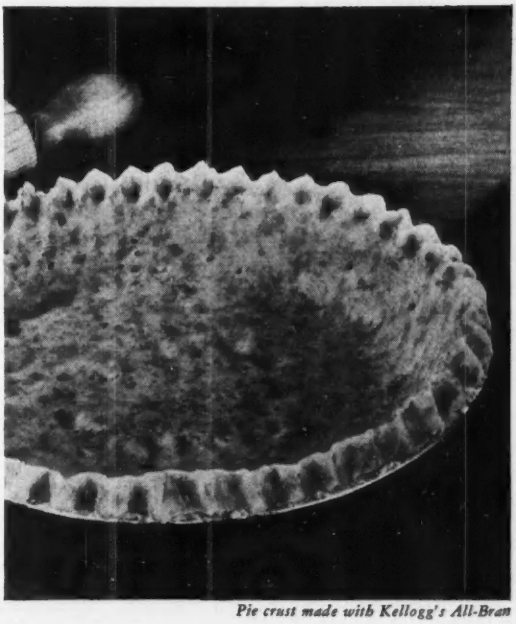
FREE SERVICE FOR DIETITIANS

Do you receive the Kellogg Menu and Recipe Service every month? If not, send in your letter now and the Kellogg Company's Home Economics Dept. will send you menus, recipes, pointers on food preparation that may prove an invaluable part of your equipment.

Dietitians are particularly enthusiastic over fluffy, nut-sweet All-Bran muffins and a host of other All-Bran favorites that we'll tell you how to make.

Address your request to the Kellogg Company, Dept. D 10, Battle Creek, Michigan.



Pie crust made with Kellogg's All-Bran

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foods for soft diets, in addition to their famous 57 varieties.

Mr. Carl Hilker of *Hilker and Bletsch Company*, Cincinnati, presented their vitamin B wafers, all claims for which have been accepted by the Council on Foods of the A. M. A., and other products for institutional use.

Horlick's Malted Milk Corporation, Racine, Wis., featured malted milk tablets and explanatory literature.

Mary I. Barber of the *Kellogg Company*, Battle Creek, showed new materials and offered the dietitians their menu and recipe service.

The *Knox Gelatine Company*, Johnstown, N. Y., featured pamphlets on the uses of "Knox Gelatine" in ulcer therapy and diabetic diets, and recipe books.

The *Kraft-Phenix Cheese Corporation*, Chicago, represented by Mary Dahnke, featured commercially made mayonnaise containing fresh lemon juice.

Libby, McNeil & Libby, Chicago, exhibited Libby's 100 Famous Foods.

J. B. Lippincott Company, Philadelphia, showed a partially complete "dummy" of *Quantity Food Service Recipes* compiled by the Administration Section of the A. D. A. under the direction of Adeline Wood, and autographed copies of Barboka's *Treatment by Diet*.

Sunshine "Graham Crackers", featuring the addition of irradiated yeast, wheat germ, calcium and phosphorus, were exhibited by the *Loose-Wiles Biscuit Company*, Long Island City.

The Macmillan Company, New York City, displayed their latest offerings in dietetic books and scientific nutrition.

"Special Morning Milk", fortified with cod liver oil, was featured by the *Morning Milk Company*, Salt Lake City.

Helen S. Kintzing, director of the Home Economics Department, *National Biscuit Company*, New York City, exhibited specialties of this concern and a supply of literature in pamphlet form.

The *National Canners Association*, Washington, D. C., showed a complete line of their institutional literature.

Mrs. Nellie H. Nelson and Nina Crigler of the *National Dairy Council*, Chicago, showed an illuminated display, "You Need Vitamins Every Day". This leaflet and nutrition news may be had on application.

Anna Boller of the *National Live Stock & Meat Board*, Chicago, presented a display of purified foodstuffs, and literature detailing a normal diet.

Pet Milk Company, St. Louis, exhibited a working model of the four steps in the manufacture of their product: evaporation, irradiation, homogenization and sterilization.

Ralston Purina Company, St. Louis, featured descriptive literature on low calorie and allergy diets.

Ad. Seidel & Son, Chicago, presented vitaminized gelatins and beverages, dried beverages, their sherbet and ice cream "Mixsa" and their usual line of fine products.

Delicious canned fruits, vegetables, pickles and relishes, in colorful array, were shown by *John Sexton & Company*, Chicago.

J. W. Stacey, Inc., San Francisco, displayed books dealing with dietetics and allied subjects. Among those shown were several new books written by members of the A. D. A. attending the annual meeting.

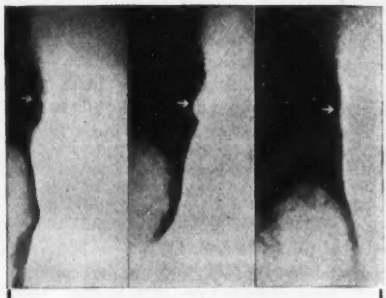
Doris H. Tisdale, home economics director for *Standard Brands, Inc.*, New York City, presented a tropical fruit salad, molded ham salad, and jellied tomato cocktail, with descriptive literature on the many fine products of this concern and many recipes.

Turco Products, Inc., Los Angeles, showed a complete line of their cleaning supplies for dietary departments.

Under the supervision of Mrs. Sarah Merrit Wenger, the *Wisconsin Alumni Research Foundation*, Madison, exhibited their Steenbock Process for enriching foods with vitamin D. Their new nutrition chart and other scientific reprints may be obtained on application.

Prompt Symptomatic Relief in PEPTIC ULCER

...with PLAIN KNOX GELATINE (U. S. P.)



CASE I—FEMALE, 74

Uncomplicated gastric ulcer first demonstrated by Roentgen rays in 1934. Diet and alkalies afforded little relief. Accompanied by loss of weight. Repeated X-ray studies in 1936 and 1937 showed no improvement. She was placed on a diet-gelatine regime in November, 1937. Relief immediate. Gained weight. Roentgen studies in April, 1938 showed no demonstrable ulcer.

CLINICAL research has recently demonstrated the effectiveness of utilizing plain Knox Gelatine (U.S.P.) in treatment of peptic ulcer. In a group of 40 patients studied, 36 (or 90%) were symptomatically improved; 28 of these (or 70%) experienced *immediate relief of all symptoms.* Other than dietary regulation which included frequent feedings of plain Knox Gelatine no medication was given except an occasional cathartic.

NO DANGER OF ALKALOSIS

This regime thus eliminates the "alkalosis hazard" attendant upon continued alkali therapy. In discussing the mode of action by which gelatine brings peptic ulcer relief, Windwer and Matzner* speak of the acid-binding properties by which proteins can neutralize acids, and they state that the frequent gelatine feedings "apparently caused more prolonged neutralization of the gastric juice."

PEPTIC ULCER FORMULA

Empty one envelope Knox Gelatine in a glass three-quarters filled with cold water or milk. Let the liquid absorb the gelatine. Then stir briskly and drink immediately before it thickens. Take hourly between feedings for seven doses a day.

*Windwer and Matzner, *Am. Jl. Dig. Dis.* 5:743, 1939.

NOTE: The gelatine used in this study was plain Knox Gelatine (U.S.P.) which assays 85% protein and which should not be confused either with inferior grades of gelatine or with sugar-laden dessert powders, for these latter products will not achieve the desired effects. When you desire pure U.S.P. Gelatine, be sure to specify KNOX. Your hospital can get it on order.

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WHO'S WHO IN THIS ISSUE

John H. Talbott, M.D., is an associate in medicine at Harvard Medical School and assistant physician at the Massachusetts General Hospital. His professional interests include gout, Addison's disease and various problems of acid-base metabolism. **Frederick S. Coombs,** M.D., is a research fellow in medicine at Harvard Medical School and also at the Massachusetts General Hospital. He has been an associate in Dr. Talbott's laboratory during the past four years and has aided in many laboratory investigations.

Hazel E. Munsell, Ph.D., is well known to dietitians as an authority on the subject of the vitamins. Her primary interest for the past twenty years has been the investigation of the vitamin content of foods. She is junior author of *Vitamin Content of Foods,* published by the Bureau of Home Economics, U. S. Department of Agriculture. Dr. Munsell has written extensively on the subject of the vitamins and other phases of nutrition. From 1924 through 1937 she was in charge of the work of the Nutrition Studies Section of the Foods and Nutrition Division of the Bureau of Home Economics. During 1938 she assisted Frances Stern at the Boston Dispensary in the preparation of a popular bulletin on the vitamins. Since February of this year she has been at Columbia University assisting Dr. Henry C. Sherman on the determination of riboflavin values in foods.

C. M. McCay, biochemist, is a former student of the late Professor Lafayette Mendel of Yale University, where he spent two years as National Research Fellow. Dr. McCay is professor of nutrition and in charge of the Laboratory of Animal Nutrition, New York State College of Agriculture at Cornell University, teaching graduate students and devoting most of his efforts to research. His present interests concern largely the problems of aging and he is one of a distinguished list of contributors to the *Problems of Ageing* edited by E. V. Cowdry, having contributed the monograph on "Chemical Aspects of Ageing". In addition Dr. McCay is interested in problems of fat metabolism, the toxicity of cod liver oil, the utilization of fats of different melting points and the lipids of the bone marrow.

Siegfried Maurer, M.D., is associate professor of pathology at the University of Chicago, member of the staff of the Otho S. A. Sprague Memorial Institute, and devotes part of his time to private practice as an internist. Dr. Maurer pioneered in the field of nutrition in experimental psychology.

C. I. Reed, associate professor of physiology, College of Medicine, University of Illinois, received his Ph.D. degree from the University of Chicago and has partly completed the requirements for the M.D. degree. During the World War Dr. Reed was a pharmacologist attached to the Chemical Warfare Service with the rank of first lieutenant. Later he was National Research Fellow at the University of Chicago. He has recently completed a monograph on the physiology of vitamin D.

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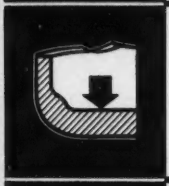

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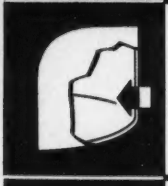

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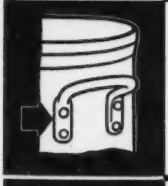

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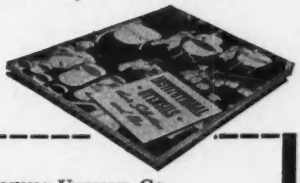

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